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American Machinist

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Volume 70 | New York, March 14, 1929 | Number 11

Centralized Records for Efficient Tool Control

By N. J. Bowne and N. Holve
The DeLaval Separator Company

A method of small-tool control, including cost, storage and maintenance, that has resulted in great savings in a large manufacturing plant

EVERY plant engaged in the production of many parts varying in size and accuracy has the problem of small tools to contend with, from the angle of having efficient tools on hand when needed and in the quantities needed, from the angle of surplus tools, and from the angle of keeping the entire tool cost under control.

Each plant must, of course, study and solve its own problems, there being no two plants that are working under the same conditions. There are, however, similar general conditions existing in many plants, the activities of which, too often, do not include sufficient consideration of the large item of expense caused by the designing, making, storing and maintenance of small tools.

In many plants the conditions are similar to those that formerly existed in our own organization; the responsibility for designing, making, storing, recording and maintaining tools was scattered. "Everbody's job was nobody's job." Consequently, the cost of these activities was not properly controlled, with the usual result of excess cost and unreasonable delays.

Our organization consists of about 1,000 men, and we had, before commencing the analysis of the tool situation, about 15,000 different tools. The expenditure for tools increased steadily during the past few years, with a considerable peak in 1926. Tools were made in a special toolroom, but aside from this activity, no other distinction was made between tools and our regular product. The designing, issuing of orders, ordering and storing materials, storage of tools, maintenance of tools, etc., were under the jurisdiction of the various departments responsible for the production activities.

The first part of the article. The second part will appear in an early issue.

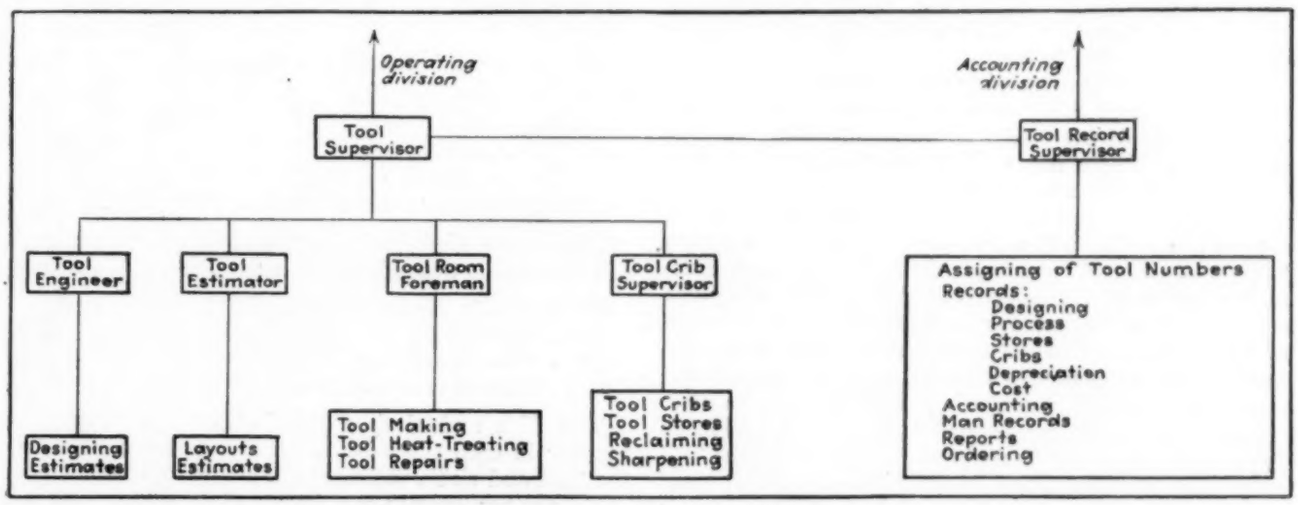

Fig. 1—Organization chart showing how the responsibilities were centralized after the new tool control system was adopted

Due to the old system of scattered records, which was tied up with the general system, a surplus stock of more or less obsolete tools accumulated. A thorough analysis of one of the recent inventories showed a surprisingly large percentage of obsolete tools, many of which were specially designed and had not been used for two years or more. Each of several departments, such as the designing, the toolroom, the planning, the accounting and the stores, kept records of their particular ends of the matter, with, of course, many duplications. There was a possibility of more than twenty-five permanent records for each tool, scattered throughout six departments.

Obviously, a clear view of the situation was impossible with such divided responsibility. This was clearly shown by a report and a diagram showing the complications of the organization as it was, and the numerous departments involved from the designing of a tool to its completion. It was shown among other things, that thousands of dollars were being spent for tools without proper consideration being given to the number of parts a given tool would produce. These reports thoroughly convinced the management of the necessity for centralizing the responsibility connected with tools and tool records.

Supervisory Positions Created

The position of tool supervisor, or assistant superintendent in charge of tools, was created. This position covered the responsibility for the design, manufacture, storage and maintenance of all small tools. There was also created the position of tool-record supervisor, under which was placed the responsibility for costs, designing data, and all other records formerly scattered throughout the several departments. The tool-record supervisor is responsible to the accounting department. These departments are located adjacent to each other and work in the closest co-operation, one being responsible for accomplishments, the other for clerical details, as well as accounting for what has been accomplished, and as a service department to the tool control, assisting it in any and all ways from the combined records which will be described later.

The tool supervisor is assisted by the tool engineer who is in charge of designing; an estimator who estimates and lays out every order; a toolroom foreman; and a toolcrib supervisor who has charge of all toolcribs throughout the plant, as well as the master toolcrib and the tool-reclaiming department. The accompanying organization chart, Fig. 1, shows the line of responsibilities after centralization.

A basic factor in organizing our tool control, in reality the foundation of the system, and a point that forced a detailed study of every tool in the plant, is our numbering system. There was much discussion as to whether or not we should adopt a new numbering system for tools. It was decided that without a proper classification it would be difficult, if not impossible, to control such a large group of tools as are required in a plant manufacturing thousands of small parts. The problem was given considerable study and was then presented at a meeting of all the foremen in the organization, after which the new numbering plan was decided upon, in spite of the tremendous task of renumbering all of the tools in use.

Under the old system, we had three methods of identifying tools; the "T" series for perishable tools; the "R" series for so-called plant tools, while purchased tools were identified by a symbol. Neither the "T" series nor the "R" series, which were both consecutive, gave any classification other than to distinguish between tools to be charged to expense and those to be charged to plant. For example, tool No. 1 in the "R" series could have been a small gage having a value of ten dollars, while tool No. 2 in the same series could have been a punch and die costing several hunderd dollars. The difficulty of record- and store-keeping can easily be seen when the statement is made that the "T" series included almost 4,000 and the "R" series over 21,000 numbers. It was very difficult to determine whether or not we had a suitable tool for making a certain part, therefore, duplications could hardly be avoided.

Digit System Adopted

Of the several systems of classification, we adopted the digit system as being best suited to our needs. This system has a trifle less possibility for fine classification than some of the other systems, but it serves the accounting purpose without an additional code. Also, there can never be any question as to whether or not a number is complete, as the number of digits must always remain constant, while in other systems there is no such absolute control against incomplete numbers or symbols. The only disadvantage of the digit system is that great care must be exercised at the outset in selecting the proper number of digits to allow for sufficient future expansion. For an average plant, six digits ought to provide for unlimited expansion, as well as for a fine classification.

In our system, every tool of exactly the same design has the same six-digit number. The first digit indicates the main class of operation the tool is to perform, as follows:

100000 Circular tools for cutting off, facing and forming
2..... Flat tools for turning, planing, shaping and slotting
3..... Impact tools
4..... Tools for making holes
5..... Tools for holding and steadying
6..... Tools for holding and steadying
7..... Tools for cutting threads and gears
8..... Tools for grinding and polishing
9..... Tools for measuring and checking
0..... Tools for miscellaneous use

The second digit indicates a main group of tools under a certain class of operation. For example, it would indicate the following tools in the 400000 class:

400000 Unclassified
41.... Broaches
42.... Drills
43.... Drills
44.... Reamers
45.... Reamers

The third digit indicates a subdivision of the main group, for example:

420000 Drills
420... Unclassified drills
421... Taper-shank twist drills
422... Straight-shank twist drills

The fourth digit indicates the main size where such classification is desired, for example:

422000 Straight-shank twist drills
4220.. Unclassified
4221.. From 0 to 20 mm. in diameter
4222.. From 20 to 30 mm. in diameter

The fifth and sixth digits indicate the consecutive number in each subdivision. Zero, as any digit except the fifth and sixth, indicates unclassified miscellaneous.

To further explain the fourth digit, which indicates main size, depending on the class of tools, this digit changes for every 1, 10, or 20 mm. size, which means,

for example, that we have 99 possibilities of different plain milling cutters (class 156000) within 10 mm. thickness; 99 possibilities of different grinding wheels (class 815000) within 100 mm. diameter, and so on. The correct size classification is given for each subdivision in our detailed classification lists.

The main feature of this classification system is that all similar tools within a certain size of rather close limits, have exactly the same first four digits. In other words, these figures tell us something. For example: every taper-shank twist drill over 20 but under 30 mm. diameter has six-digit number beginning with 4212, which four figures convey this information without referring to any records. As an illustration, we have:

400000 Tools for making holes
420000 Drills
421000 Taper-shank twist drills
4212000 From 2 to, but exclusive of, 30 mm. diameter

Another important feature is that this system forces classification. A new tool cannot be numbered by merely adding another decimal or letter as in other systems. The six-digit number is used all the way through to identify the tool, being used for the drawing number for every tool that can be conveniently drawn on a standard 8½x11-in. sheet; for records of all kinds; and is stamped on each tool made. Each tool also carries a serial number, so that we can at any time refer to the order on which we made any one tool found to give unsatisfactory service, in which case the material used or method of manufacturing may be changed, if found desirable.

Aluminum Finishing

IN AN article on aluminum polishing in *Grits and Grinds*, A. Rousseau, of the Norton Sales Engineering Department, points out that it is a loss of time to use abrasive either too fine or too coarse for the roughing operation when a high finish is desired. Time gained in roughing, using coarse abrasives, will be lost on the following operations in removing the coarse roughing marks, while too fine grain sizes reduce the rate of production without giving a better final finish.

Where considerable metal is to be removed from heavy aluminum castings a sewed buff, felt or canvas wheel, should be used with No. 60 aluminum-oxide abrasive or its equivalent. Sand cast pieces, with small pit holes and rough exteriors, are most successfully roughed with a greased wheel. On die-cast pieces that are fairly smooth, from No. 90 to 180 abrasive can be used.

The polishing of sheets is readily done on a felt wheel set up with No. 180 aluminum-oxide abrasive and buffed with a felt wheel which gives a much better finish than a cotton buff. On sheets and flat work it is advisable to change the direction of the strokes when changing from one size of abrasive to the next finer. Where only press marks are to be removed from sheets, polishing can be done directly with a buffing wheel using tripoli for the polishing agent.

A plentiful supply of grease, tallow, or other lubricating agent must be used on all polishing wheels. All roughing scratches must be removed in the finishing operation. Dry roughing wheels make deep scratches in which the buff wheel will drag and make deeper. Grease sticks, beef tallow, or kerosene are used in roughing. Where a high color is desired lime and rouge are sometimes used after the tripoli in the final finishing operation.

Indifference to the Apprentice System

By A. W. Forbes
President, Forbes & Myers

AS PART of our exhibit at the recent Worcester Industrial Exhibition, an apprentice worked on a metal-stamping die, cutting out varied-shaped openings. The following sign explained what he was doing.

Demonstration of the work of first year apprentices in

DIE MAKING

Every regular apprentice is also given practice in all operations in making electric motors, including the following:
Winding and Connecting Electric Motors
Assembling, Painting, Crating
Machine Tool Operation
Acetylene Welding
Care and Repair of Machinery and Motors
Mechanical Drawing
An opportunity is given for advanced study.

FORBES & MYERS

For about fifteen hours, I was in charge of the booth with the apprentice at work. During this time there was an almost continuous line of people passing, a most cosmopolitan crowd, all ages, from small children to men well past 80, all classes, from the leaders in business and the professions, to the street boys who had climbed the fence to save the small admission, all nationalities that are found in the usual manufacturing city.

Many stopped to see the boy at work, they took an interest in what he was doing, as well as in the other mechanical exhibits in our booth. But we did not receive a single inquiry about apprenticeship. Not one inquired as to the kind of positions for which apprentices prepared, or the future of the boys. Not one asked for more details as to what the boys did than were given on the sign. Not one asked about requirements for admission. But one was heard to ask the boy, "Where did you learn to do the work? At the trade school?" I think this is a typical attitude of the public today, and it is a new attitude. In 1920, when our apprenticeship was described in a newspaper we had several applicants, none of them properly qualified, but at least a few were interested. In the last five years we have not had a single applicant, other than those to whom we made the first move. And this exhibit failed to disclose the slightest interest.

The cause of the indifference seems to be disbelief. The public is so fully convinced that there is no real apprenticeship that they do not care to inquire about it. They take the same attitude that they would toward a man who offered to give away five-dollar bills. They feel so sure that it is not being done that they do not care to hunt for the trick.

In a recent summary of machine tool exports and imports into Great Britain it was noted that the value per ton was greater for imports, with one exception, than for exports. In all but milling machines the value per ton was noticeably higher for imports, as would be expected. In this case, however, the imported machines show a much lower value per ton than those made at home.

Can Shop Loss Be Charged to Sales?

"HERE'S a new one for you, Bill," said Harry Lewis, head of the Lewis Company, as our counselor, Bill Holland, sat down in his friend's office the other day. "My production man has a sense of humor, anyway."

"Well, Harry, you know I like to be amused," replied Holland.

"It sounds sort of preposterous, Bill, but Jones here seems to mean it. He wants me to charge the sales department with the cost of some of our special piston pins."

"Not very clear, Harry. Suppose you tell me about it, Jones," turning to the production man.

"No joke about it, Mr. Holland. Here's the situation. We make many odd sizes of pins in very small lots just to satisfy special customers. Take that large pin we make for replacements on one of the big tractors as an example."

"He wants to charge this whole thing up to sales, Bill, just because we sell only a few of them," broke in Lewis.

"It sounds funny to Mr. Lewis, but it seems perfectly clear to me," continued Jones. "We don't sell over a dozen of these pins a year, in lots of two or four at the most. Of course I start through a lot of twenty-five—it's hardly worth setting up for less. I can't finish the pins because we never know just how much 'oversize' they have to be. So I rough them out, leaving enough for the largest size, and grind to the size wanted. Those pins cost more than Mr. Lewis seems to think."

"But why do you want to charge them to the sales department, Jones?" asked Holland.

"That's easy, Mr. Holland. I've wanted to drop making those pins long ago because there's no money in it for the company. But the sales manager makes Mr. Lewis believe it's good business to keep them in stock, even at a loss. Says it helps us to get other business."

"Of course it does, Holland," said Lewis, "you know how that is. You have to take a loss once in awhile, on some things. And when customers get to coming to you, you want to be able to supply all their needs—in your line, of course."

"Even at a loss, Lewis?"

"Well—er—yes, if it doesn't foot up too much at the end of the year."

"And how do you answer that, Jones?"

"By charging the cost to the sales department, Mr. Holland. That's what I'm trying to make Mr. Lewis see. If we only carry those pins as a drawing card for other business, how do they differ from blotters, or calendars, or any other form of advertising?"

"You don't object to those, do you, Jones?" asked Lewis.

"Not at all, as long as you charge them to the sales department. If the sales manager throws a theater party for a good customer, it's no affair of mine. But if he tried to run it in on my production department cost, I'd put up a stiff kick, just as I'm doing about those tractor pins that he uses as a chromo, to lure orders for pins that are profitable."

"Did you ever hear anything like that, Holland?" demanded Lewis.

"Can't say as I have, Lewis. But it may be worth thinking about at that. And you're to be congratulated on having a production man who takes pride enough in his department to want costs put where he thinks they belong."

"But we pay the cost anyhow, Bill, no matter where it goes."

"Sure thing, Lewis, but it isn't a bad plan to know just *where* it does go."

Executives are invited to discuss the problem involved in the foregoing case. They are also urged to use this department to air their own problems. A letter to the Executive Forum Editor is all that is needed.

EXECUTIVE FORUM

Discussion

Day Work or Piece Work

From the workman's angle, the limits of a day rate plan are, at bottom, the point of inefficiency which brings discharge, and at top, the attainment of excellence which may or may not be rewarded by promotion. Within these limits, day rate pays exclusively for the workman's time, taking no account of quality or quantity of work done.

A piece rate plan is not a one-sided bargain like time payment, but may be nearly as inefficient if either time or rate is carelessly set. Piece rates are sounder in principle than time rates and fully as simple to understand. Wages per day are not guaranteed, and the worker's earnings depend mainly upon his own effort. Of course, the temptation exists for the manufacturer to cut rates if set too high.

From my viewpoint, the chief objection to the day-rate system is that it offers no inspiration to any worker, good, bad, or indifferent. Moreover, it encourages such vicious uneconomic practices as limitation of production. There is enough leveling of workers and lack of opportunity for growth to commanding positions under our present industrial system, without unduly adding to them through the influence of an unsuitable method of wage payment.—HARRY KAUFMAN, *Public Accountant.*

The "Can't-Be-Done" Man

Opposition to new ideas and methods of operation, by the older members of a force, seems to be common, and is well exemplified in the case of the firm with which I am connected.

This concern, because of a large increase in business, was forced to expand, and as a result it built a second large plant about half the size of the original plant. The new plant was manned with supervisors who had been trained in the older plant. Most of these, from the general foreman down, were men with many years service and the transfer was in the nature of a promotion for faithful service.

It so happened, that, although the same product was manufactured at the new plant, the equipment installed was the latest obtainable and much advanced over that in use at the old plant, thus creating possibilities for many changes in methods and processes. The supervisors, however, having been schooled in the older plant, seemed totally oblivious to the possibilities of the new machines and continued to process their material in the same manner as at the older plant. Moreover, when changes were at first suggested by the technical branch in charge of manufacturing processes, which consisted chiefly of newly-hired graduate engineers who found many possibilities for changes, the supervisors were always certain to exclaim, "Out at Blank's, we always performed the work in this manner," and let it go at that.

At first it was quite a task to convince these older men that their methods were obsolete, but gradually, as more and more cases were brought up showing their errors in judgment, they came to the point where they began to welcome suggestions. —J. KOLLARIK.

Should a Buyer Specify Design or Results?

Fortunately, we are growing fundamentally conscious of the value of buying production. This realization, of course, leaves details of design up to the machine builder, who, if he is of the type we should be doing business with, is far better equipped than the purchaser to work out these details to the maximum general advantage. If, however, we are dealing with special conditions as to material, tolerances, operating personnel, etc., which are not general to the users of the particular machines, it is up to us to recognize this fact, and deal with the situation accordingly. To force, or attempt to force, into the machine special design features which are expensive, merely because we need them or think we do, is not playing fair with the machine builder.

We can, obviously, within reasonable limits avoid or minimize difficulties such as tie-ups and spoiled work when working a machine on our product under our own conditions, by incorporating special features into the machine. To be arbitrary about such matters is unfair. We should ask for two prices, one on the standard machine, and one on a machine incorporating our desired features. If really worth it to us, we can then pay the price for the special design.

—ACHILLE J. MORLAND.

How Much Overhead?

The amount of overhead that should be applied to any particular industry depends upon how the expense charges are classified; and these again are determined by the type of manufacturing one is engaged in. Whatever system is adopted, overhead cannot be reduced to a percentage of labor cost, a rate per hour, or any other basis of distribution, until a thorough study has been made.

In many manufacturing plants we find a tendency to look upon an increase in the operating

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expense of any department as a sign of inefficiency on the part of the department head. But, an increase in operating expense, with its resultant greater overhead charges, is not necessarily caused by inefficiency, but can be quite the opposite.

In these days of mass production, made possible through the development of automatic machinery, a new element has been introduced into manufacturing, namely, the lowering of labor costs by the increasing of operating expenses. Where formerly the large percentage of manufacturing was done by manual labor, it is now being performed on automatic machines, the purchase, maintenance and operation of which entail considerable expense. Therefore, if we use productive labor cost as the basis for determining the overhead to cover the amount of expense incurred during a certain period, it must be remembered that a decrease in the productive labor cost caused by the introduction of automatic machinery will make operating expenses higher, and consequently the percentage of overhead to labor cost will be considerably greater, because of this inverse ratio. —R. A. MAXWELL, *Canada.*

Overhead and Profits

The plan of including in overhead, as two items of manufacturing expense, the going interest rate on the capital investment, and depreciation based on replacement value of equipment, may be a good procedure for estimating selling prices; but as a general accounting method it is almost certain to distort and obscure the financial statements, with little compensating benefit.

If interest on invested capital is included in manufacturing cost on the annual statement, then the item of "profit" on this statement will presumably represent the profit above the assumed current interest rate on the capital investment. This figure depends first upon what we consider our capital investment. Is it the capitalization, or is it the market value of the stock? It surely cannot be the original thousand dollars with which the business was started 50 years ago.

Another indeterminate variable in our so-called profit is the interest rate. Still other points of difficulty are the practical problems of apportioning this interest charge equitably among the different kinds of work passing through the shop, and of keeping track of how much of this earned charge is buried in the "stock on hand account" and "finished parts account." When we have finished, are we any better off in knowing that we have earned 4 per cent above an assumed 6 per cent on our stock, than if we knew we had earned 10 per cent on our stock?

The proposition of charging depreciation on replacement value has been ably championed, but I remain firm in my opinion that the proper basis for depreciation is not cost of replacement by something better, but cost of reproduction at current prices. It seems to me very unsound accounting to say that, since we shall some day want to replace a certain machine with a better and more expensive one, we must therefore accumulate a depreciation reserve against the old machine equal to two or three times its reproduction cost. Such a practice is virtually selling our customers an old-fashioned machine tool for the price of a modern one, and at the same time charging them for the inefficiency of the older machine. It would be just as logical to say that, by the time a certain machine wears out, our business will have increased to the point where we shall need three such machines, and that we must therefore depreciate the present machine on the basis of three times its value.

The practical consequence of this system will be that the management, finding itself with a depreciation reserve which is twice the reproduction value of the equipment, may be tempted to dip into the excess reserve for dividends in hard times. The funds which any well-managed business should set aside for the purchase of improved or additional equipment are certainly not part of current machine expense, but belong in the "reserve for new equipment," where they will be recognized as a form of undivided profits, to be "plowed back" into the business.

—C. S. HAZARD.

The Man Over Fifty

There is no general law governing the age at which a man is past his ability to work. Some men never reach it; others are masters of it at 60. It depends largely on how far the work and the man are really suited to one another, and to what extent the work ceases to be a drudgery and becomes a hobby.

Naturally, it depends also on health. Given ordinary good health, it would appear as though work tended to prolong life and not to shorten it. The uprooting of the regular habits of a lifetime appears to undermine a man's stamina and to take from him his hold upon life. Instead of a man saying that he is so old he ought to retire, I can quite imagine his saying that he is so old he dare not retire. Of course the "too-old-at-fifty" crusade is popular with young men of twenty, but, then, many things are popular with them.

Why should an engineer or machinist cease to be in demand merely because he has passed 50? This is a problem that has always been a puzzle to me. Personally I prefer to employ men between 45 and 55 because they have had long experience and are in their intellectual prime. I am strongly of an opinion that the man who has passed the fiftieth milestone cannot be discarded without detriment to our industrial organizations.

—E. ANDREWS, *England.*

Cadmium Plating As a Rust Preventive

By Philip Sievering
President, Philip Sievering, Inc.

A thin coat of cadmium is less expensive and a more effective rust preventive than grease, and is one of the easiest metals to electroplate

CADMIUM plating as a protection against corrosion for steel and brass parts, especially for the inside parts of machines, has been finding an increasing application. Although cadmium is an expensive metal, the cost of a suitable rust-resistant coat of cadmium is no more expensive than nickel plate because of the very thin coating of metal required. It is one of the easiest metals to apply by the electroplating process, and it has many inherent advantages that make it ideal as a coating for such articles as radio parts, and the inside parts and mechanisms of typewriters, cash registers, and office machines. It is also used to replace nickel plate on metal parts of toys and novelties, and to replace zinc and hot tin dips. It has lately found quite extensive use for automotive and airplane parts. Another use is for plating screws, pins, and washers that are made in large quantities for stock. The application of a thin coat of cadmium has been found to be less expensive and more effective than the application of grease to prevent rust, and the parts are then ready for assembling directly from stock without cleaning.

In this article the author gives the reasons why cadmium plating is growing in importance as a rust-preventive for machine parts, and tells how the plating is done in a large contract and job plating plant

Cadmium plate has the advantage over zinc, or "galvanizing," that it has a finer initial appearance, and will retain its original color. Zinc coatings become dull, and they darken on short exposure to the air. Cadmium has a silvery-white color and much resembles tin, although the matte plate applied to steel or brass without polishing gives the color and appearance of some aluminum alloys. The metal is a by-product of the zinc industry, and was formerly not separated but melted in with the zinc metal, the first commercial production on any considerable scale being in the year 1923. As a rust-resistant coating it is superior to nickel, but it does not have the wear-resistance of nickel and is therefore not as suitable for outside surfaces that are exposed to friction or wear. It has the advantage over tin that it is easier to apply.

Articles to be cadmium plated are first cleaned of all grease, oil, or dirt film. Most of the parts and assembled mechanisms ordinarily cadmium plated are pressed metal or screw-machine products of cold-rolled steel or brass and do not require polishing. In some cases, however, such as screw machine products that are required to be smooth, they may be given a tumbling in wooden barrels with steel balls and a soap and water solution.

The cleaning process for steel and iron parts consists of dipping in a hot potash or soda solution to neutralize and remove the oil and grease, then a pickle dip consisting of a cold solution of 5 to 10 per cent of hydrochloric or sulphuric acid in water. The pickle dip produces a uniform bright surface on the parts. From the pickle the parts go into a cold solution of cyanide of potassium or cyanide of soda in water. The soda is more frequently used as it is less expensive than the potash. The cyanide dip is for the purpose of removing any remaining film left from the air or acid. For brass parts the acid pickle is not required, as the alkaline dip gives a satisfactory clean and bright surface.

Cadmium, like nickel, can be plated by the barrel method as well as in still tanks. Barrel plating is employed for quantity production on large lots of similar parts. The standard plating barrel is used. No undercoat of copper or other metal is needed for plating cadmium on iron and steel. The plating baths may be either acid or alkaline, the latter being largely used. The alkaline bath consists of a water solution of cyanide of potassium with the addition of caustic soda (sodium hydroxide). Cadmium oxide is then added to get the metal into the solution, but unlike the process in chromium plating the oxide does not require replenishing, as the solution is "self-balancing," and the cadmium metal for the plating comes from the cadmium anodes hung in the solution. The still tanks used for cadmium are of iron instead of the wooden, asphalt-lined tanks used for nickel. In large plating shops where all kinds of plating are done the cadmium baths are grouped with those for copper and bronze because of the similarity of solutions.

The electric current density for cadmium plating may be anywhere from 5 to 19 amp. per sq.ft., depending on whether the solution is still or agitated. This consequently makes it much more rapid than nickel plating, for which not more than 6 amp. are ordinarily used. If the parts are moving or the solution is agitated the current density can be increased, with consequent reduction in time required for plating. The solution may also be used either cold or hot. With a hot solution the time

of plating can be reduced considerably. To obtain the desired color, however, all factors have to be watched and the proper equilibrium obtained. Ordinary still-tank plating with a cold solution gives a plate about 0.0002 in. thick in about 15 min. This thickness of plate gives greater rust-resistance than a much heavier coating of nickel, and is considered sufficient for interior parts, and for such mechanisms as radio condensers. For exposed parts, where greater corrosion-resistance is required, a plate 0.0005 in. in thickness is applied. For the best "highly protected" parts a coat 0.001 in. in thickness is sometimes used.

After the parts are removed from the plating bath they are rinsed in cold water, and then in hot water. The latter is for the purpose of aiding the drying. Parts that do not have threaded holes, slots, or narrow corners may be dried after the hot water rinse by dumping into hot sawdust. This gives an even dry with no danger of streaks. The parts are then easily sifted from the sawdust in either a hand or a mechanical sieve.

As can be seen, the process of cadmium plating is no more difficult than that for nickel plating, and in many rust-proofing operations it has definite advantages. Cadmium is a soft metal, like tin, and the process of cadmium plating should not be confused with that of chromium plating which produces a hard, wear-resisting surface as well as a rust-resistant coating. Cadmium replaces zinc and tin coating very effectively with advantages in appearance and ease of application. A poorly applied plate of cadmium may have the fault of being brittle, but when properly put on with correct solutions and temperatures the plate will give long service and retain its original silvery-white surface.

Inspection Methods and Their Application—*Discussion*

By Trevor Bonsall
Surrey, England

IN THE article on page 499, Vol. 69, of the *American Machinist*, the illustration 86 is apt to mislead some who may read the article. As shown, the method demands perfect squareness of piston body and base, suggesting a previous check for squareness, whereas beyond a locating value during machinery operations, the squareness of ends has small bearing on the piston function when in service. Sometime ago the *American Machinist* showed a better method for this check, consisting of a test bar fixed vertically to a substantial base. The piston under test was wrung onto this test bar and the clock indicator applied to the piston body as it lay in a horizontal position on the test bar.

Reading the article further, the persistent check for roundness is noted. It may not be amiss to mention the deliberate putting out of round of pistons by one maker of a British high-grade light car. When the pistons arrive at the grinding operation, an expander is inserted between the wrist-pin bosses and used to distort the piston several thousandths of an inch. The expander is left in place during the grinding operation. On withdrawing the expander, it will be found that the skirt end of a piston has taken the shape of a slight ellipse, gradually returning to the round as the ring end of the piston is reached. In service the fitted piston enters the cylinder freely at the ring end, requiring a certain amount of push as the skirt end is reached to overcome the spring set up by this method of grinding.

SEEN · AND · HEARD

By John R. Godfrey

Starting up cold machines—Quick-acting fixtures—Drilling deep holes

SPEAKING of lubrication, there seem to be several points on which many of us are still at sea, such as the matter of starting up a machine that has been standing for a long time. Whether the machine is light or heavy, but especially in the latter case, the lubricant has a good chance to be squeezed out of the bearing, or at least to be forced to the upper side. Starting up a machine with the bearings in this condition, especially if it is cold and the lubricant thick and sluggish, may do considerable damage before the oil gets distributed around the bearing. It is true that we have this condition in all automobile engines in cold weather and they seem to survive the ordeal. But who knows how much longer they might serve if this condition could be avoided?

* * * *

Accuracy is the first essential of jig and fixture design. But unless the fixture is also designed so as to permit pieces to be put in and removed quickly, it is not completely successful from an economic point of view. It behooves tool designers to study various methods of holding work very carefully so as to be able to select a method to handle as rapidly as possible whatever piece or operation is necessary. This is now especially to the point since, with the reduction in machining time that is promised by the new cutting alloys, the time taken to handle work in and out of the fixture becomes increasingly important.

* * * *

Consideration of lubrication is not confined to metal-working machinery. The automobile engine is coming in for more careful attention, even though most of us thought it was pretty well settled before. Whether it is due to the use of higher compression or not, piston pins are receiving more attention than ever. Several motor builders are now drilling oil holes lengthwise of the connecting rods so as to deliver oil under pressure direct to the piston pins.

Years ago, some of the more expensive cars fitted a small copper pipe in the channel of the connecting rod, fastening it to the web by small clips, or even brazing the pipe in position. The effect was the same as with the drilled rod of the newer motors. There were two difficulties, however. It was difficult, if not almost impossible, to fasten the pipes so they would not shake loose, and it also added to the troubles of properly balancing the rods.

Then we were told that the pins had all the lubricant they needed from the spray, or fog, of oil that found its way up the cylinder bore. This may have been true in the days of splash lubrication and lower compression, but the fact that connecting rods are now being drilled for oil indicates that conditions have changed. The new practice introduces a new era of deep hole drilling that will mean business for a few machine builders.

Sheet-Metal Products
Their Design. Use and Construction

By Frank W. Curtis
Western Editor, American Machinist

Gears and racks stamped from sheet metal are used in a variety of small machines—They can be made to a great degree of accuracy by shaving the teeth

SEVERAL examples of pressed-steel gears are illustrated in Fig. 7. The gear at *A* is made by a combination of operations, including drawing, swaging, and blanking and shaving of the teeth. Where a hub cannot be conveniently formed, the construction as shown at *B* can be used. In this case, a steel hub made in a screw machine is assembled to a plain blanked gear by means of ring staking. The examples at *C* illustrate two forms of gears with swaged hubs. The gear shown at *D* is similar to that shown at *A* and is made by drawing a blank to the desired shape and then cutting off the hub section as shown. At *E* is illustrated a small sheet-metal gear assembled to a shaft. The example shows how a tight assembly can be made by knurling the shaft to which the gear is assembled.

Adequate stiffness of sheet-metal parts is necessary in order to avoid possible springing or misalignment. Small, heavy parts do not require any particular means of stiffening, although large, thin parts must be made with ribs to give them the propper stiffness. Several forms of stiffening-ribs are used, a few being illustrated in Fig. 8. The part shown at *A* has a cylindrical rib close to the outer edge, which has a tendency to prevent warping or buckling of the part. The example at *B* has radial stiffening ribs for the same purpose. A sheet-metal lever having ribs running lengthwise is shown in the lower example. The choice of ribs is largely dependent upon the shape of the parts. The ribs are usually formed in the blanking, drawing or other dies, so that it is not necessary to perform an additional operation.

Laminated assemblies made from a number of sheet-metal stampings are often used in the construction of parts requiring a thickness greater than can be made advantageously in a single piece. Some representative examples of laminated parts are illustrated in Fig. 9. At *A* is shown a spur gear made from six pieces of $\frac{1}{16}$-in. sheet steel. When the gears are blanked, locating and assembling holes are also pierced in them, so that at assembly it is necessary only to insert rivets through the required number of blanks and then head the rivets. Laminated gears are also made of a combination of steel and fiber by alternating these sections to suit. This construction tends to give a resilient gear, and one that will wear longer in some cases than if it were made entirely of steel. At *B* is shown a small rack made of several sections of stampings. The construction assembly is similar to that of the gear and it can be made of a combination of fiber and steel. Another form of laminated construction is shown at *C*. The part, having two end plates and a series of center stampings, resembles a forging.

An example of a sheet-metal part that has superseded a former casting is the plate shown in Fig. 10. At the left, at *A*, is shown the cast-iron part, and at *B* is shown

Conclusion of the article.

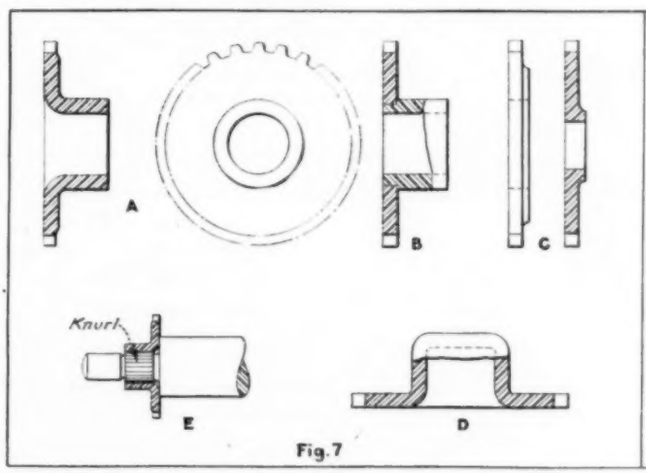


Fig. 7

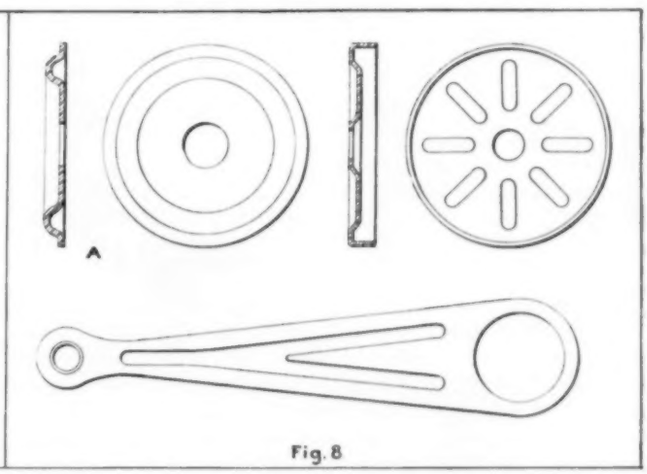


Fig. 8

Fig. 7 — Sheet-metal gears can be finished completely in dies by shaving the teeth after blanking. Hubs can be assembled as separate pieces, or if the design permits, the hub can be swaged from the body of the stamping. This construction lends itself to thin gears only. Fig. 8—When large, flat pieces are stamped, it is desirable to provide stiffening ribs in order to avoid having the parts spring out of shape. Various forms of ribs can be used, depending upon the shape of the part. The examples show ribs applied to long, flat pieces

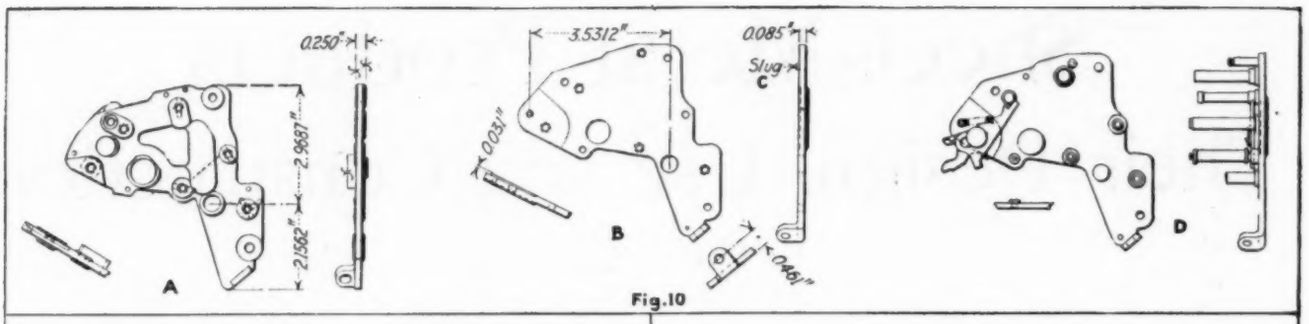


Fig. 10

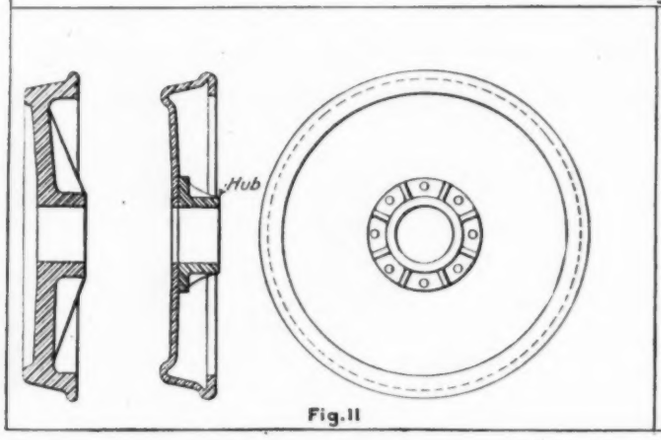


Fig. 11

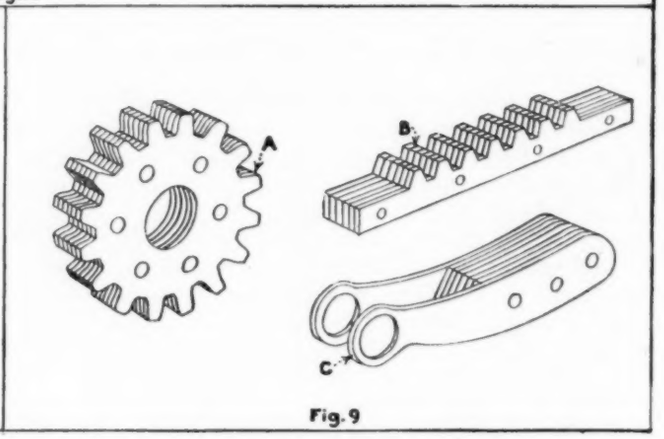


Fig. 9

Fig. 9—A number of stampings can be joined together when the thickness of a desired part is greater than can be made satisfactorily from a single thickness of sheet metal. Gears and racks can be made by this method and the teeth can be finished in a gear cutter if extreme accuracy is required. Fig. 10—Comparative features of a cast-iron and a sheet-metal part, showing the difference in construction for both parts, although the characteristics of the designs are similar. Several machining operations have been eliminated by making the parts of pressed steel. Fig. 11—A car wheel made of cast iron weighs 125 lb., whereas the same type of wheel made of sheet metal weighs only 47 lb. The sheet-metal part costs less and is just as efficient

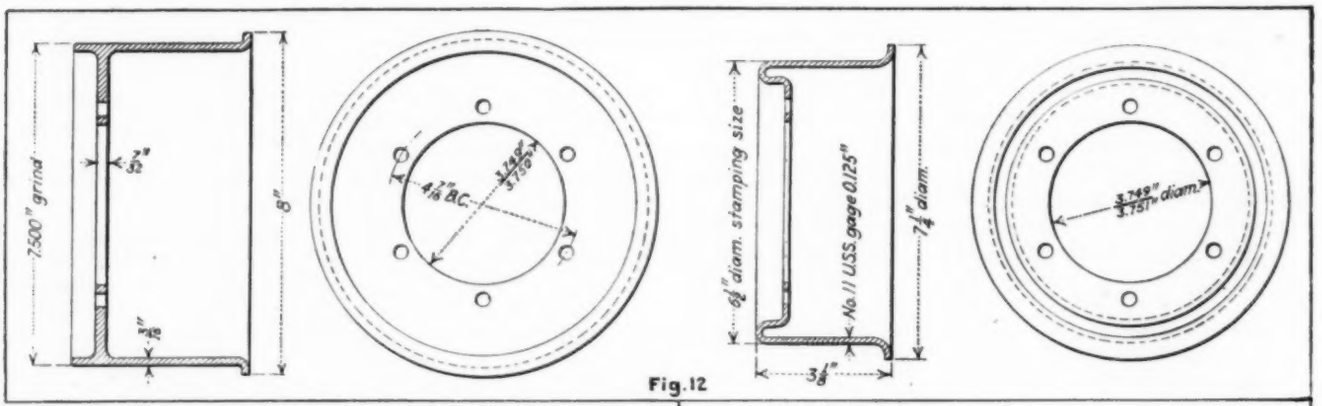


Fig. 12

Fig. 12—The sheet-metal brake drum at the right superseded the casting shown at the left. Many machining operations have been eliminated by using pressed steel, with the added advantage that it is stronger. Fig. 13—Constructional features of a small lever made of sheet steel, showing how a hub is assembled at the large end. The cost of producing the sheet-metal part is less than one-half of the cost of the part made from cast iron

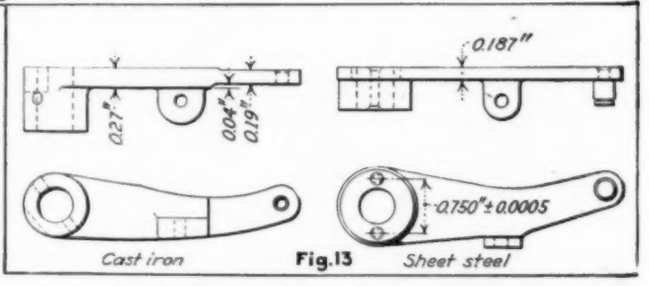


Fig. 13

the same part made of 0.156-in. steel. Another feature of the stamping is the slug shown at *C*, which is 0.144 in. in diameter and raised a distance of 0.085 in. above the top face. At *D* is shown an assembly of the plate with several studs, pawls and pins. The outstanding advantage of using sheet steel in this case is simplicity in manufacture, since parts made by press tools eliminate many machining operations.

A comparative example of a cast-iron and a sheet-metal wheel for a light rail car is illustrated in Fig. 11. The hub of the pressed-steel wheel is made by riveting a casting to the central section of the stamping. Although the use of pressed steel has reduced the cost of the product, of greater importance is the reduction in weight, the cast-iron wheel weighing 125 lb. and the pressed-steel wheel weighing 47 lb., complete with the hub.

An example in which sheet steel has replaced cast iron is illustrated in Fig. 12. The part is a transmission brake drum, formerly cast as shown at the left,

but now made of 0.125-in. sheet steel, as shown at the right. When the part was made as a casting, it was necessary to finish the surfaces all over and then balance it. The use of pressed steel required slight changes in the general shape of the part. It is finished completely in dies to the sizes specified, with the exception of the bore, which is machined in a lathe. A small lever, formerly made of cast iron and now made of sheet steel, is shown in Fig. 13. The sheet-metal part carries the same features as those of the casting although the hub is made as a separate piece instead of being formed as an integral part. The hub is assembled by two rivets having flush heads at both ends.

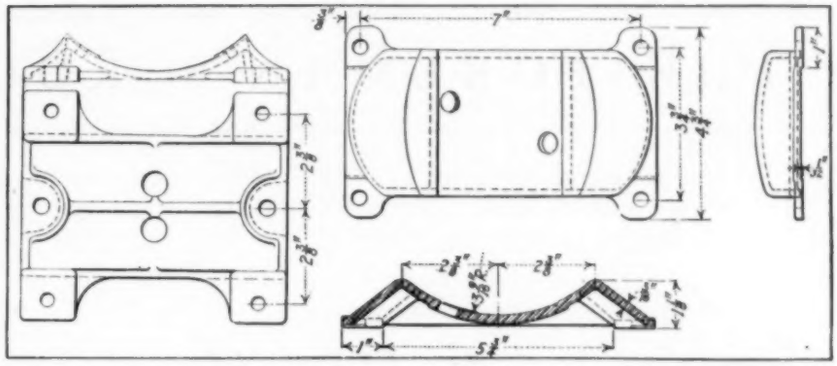


Fig. 14—A sheet-metal motor base and a cast-iron base which it superseded. The sheet-metal design has simplified the construction and building of the part. The steel base weighs about 1 lb. less than the cast-iron base

An example of a sheet-metal base for a small electric motor is illustrated in Fig. 14, in which a similar base made of cast iron is shown at the left. Sheet steel lends itself readily to the construction of parts of this nature and is less likely to break or become damaged in use. The weight of the drawn-steel base is 1.6 lb. whereas the same part made of cast iron weighs 2.7 lb. The comparison in cost, of course, is greatly in favor of the drawn-steel base, which also has the advantage of a neater appearance.

Another unusual form of pressed-steel construction is the printer segment illustrated in Fig. 15. The body is made of $\frac{1}{16}$-in. cold-rolled steel, and has the type-segment die-cast in place. The section of the stamping to which the die-casting is applied, has three dovetailed sections and four anchor holes to insure a proper means of holding the die-casting. A thin hub is ring staked at the center of the stamping, and two small pins are riveted at the smaller end. The part, as formerly made of cast iron, is illustrated at the right. When cast, it was necessary to engrave the figures on the face of the segment.

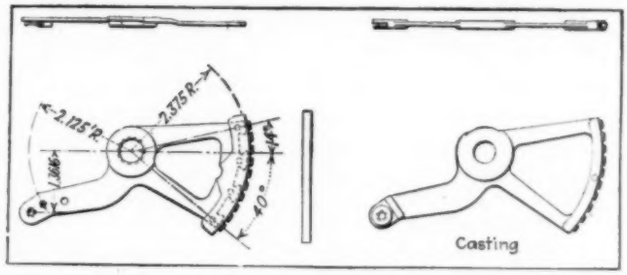


Fig. 15—A combination unit made of a stamping and a die-casting that has taken the place of a cast-iron segment, resulting in a substantial saving in cost. Both designs are shown, so that a comparison can be made

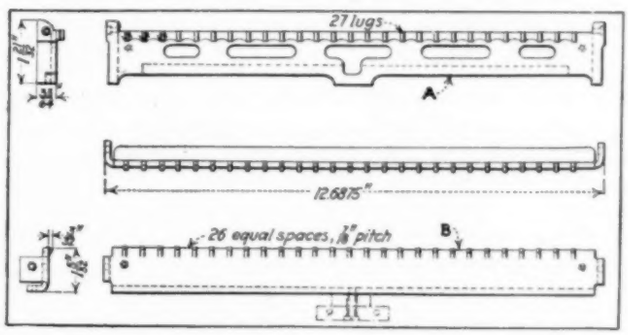


Fig. 16—A sheet-metal stamping that has eliminated a rather difficult milling operation. As shown by the casting formerly used, there are 27 lugs requiring machining. The same lugs are made in the sheet-metal part by cutting and forming the edge of the blank

An example of a sheet-metal stamping, somewhat difficult to make, is the tie bar illustrated in Fig. 16. The part, formerly made of cast iron, is illustrated at *A*, showing the various surfaces requiring finishing. Among the machining operations required is the finishing of 27 lugs on the outer side of the bar. A part of similar design having the same characteristic features, although made of 0.156-in. steel, is illustrated at *B*. The lugs are made by cutting and forming the upper edge of the blank. In this comparison, the part made of sheet metal is the stronger and is less expensive to produce.

Relative Rigidity of Cast Iron and Steel—*Discussion*

By J. F. Lincoln

Vice-President, Lincoln Electric Company

In THE *American Machinist*, page 254, Vol. 70, there is a comment by R. E. Flanders in connection with the welded rigidity of cast iron and steel which questions the statement which has been made many times of the relative rigidity of cast iron and steel.

Mr. Flanders states that machine tools can stand for very little distortion. Therefore, the modulus of elasticity which is in the ratio of two and one-half to one in favor of steel does not apply at all since any distortion sufficient to make this difference in the relative elasticity between the two metals would be far beyond what is allowable in machine tools.

The only difficulty with a statement of this kind is the fact that to have any distortion whatsoever in a machine tool certain parts of the section distorted will be stretched amply far to more than bring them beyond the point in which the advantage of the greater rigidity of steel is present.

If Mr. Flanders will consider merely the relative movement of the various parts of a beam under a bending load he cannot help but appreciate this fact. As a matter of fact, nearly half the beam is not in tension at all, but is in compression, and only half the beam is in tension. At the same time there is also a neutral axis in which there is neither tension nor compression. It is self-evident therefore that the amount of tension is widely varied between various parts of the beam, nearly half of it being in a negative tension, and the rest of it being in a positive tension going from zero up to its maximum.

· THE · FOREMAN'S · ROUND · TABLE ·

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

An Unemployment Fund

"SORRY I missed riding home with you last night, Ed," remarked Al, "but Williams asked me to stay awhile, and offered to take me home in his car, if I would. On the way home he told me about an unemployment fund a concern over in Alta has."

"What do you mean — unemployment fund, Al?"

"Well, this particular concern feels a real sense of responsibility towards its men. In 1920, after it had made up all the parts ahead that it could, overhauled equipment, and still had to lay off men, the executives felt pretty badly about the hardships that followed in their employee's homes. The board of directors vowed they wouldn't let it happen again, so they created an unemployment fund."

"Where'd they get the money, Al?"

"Well, the firm started the fund by a $6,000 contribution, and then added 2 per cent of the weekly payroll until they reached the predetermined amount of the fund."

"How'd they figure out how much it should be?"

"Like this. They decided on 3 weeks' compensation for a man of six-months' standing, 5 weeks for a year's service and up to a maximum of 26 weeks for a man who had been with them 5 years or more. Then they said they would pay 75 per cent of his wages to a man with dependents, and 50 per cent to one without. They figured that 1920 was as bad a time as they'd ever have, so they took their pay-roll and employment records and translated them into the amount of money it would have taken to carry this out then."

"Must be an awful lot of money," volunteered Ed.

"Not nearly as much as you'd think, according to Williams. You see, Ed, the old men who'd get most are naturally the best, and would be the ones kept on."

"Well, I'd hate to think of the loafing that would go on under such a fund—a man who was discharged would be sitting pretty."

"They take care of that, too. A man must report to a joint committee of management and men three times a week, and tell what effort he has made to find another job. If he doesn't try, he goes off the list. When he gets another job paying as much or more, he's off the list. If it's less, he's paid from the fund on the difference."

"Why don't they have the employees contribute to the fund, Al?"

"'Cause they feel that steady employment is the company's responsibility."

"Well, if it's all their money, what's to prevent the company using it in a pinch?"

"They have it on deposit in a trust company, with a non-revocable trust agreement. If they didn't it would be taxable as undivided profits. As it is, it's tax free."

Contributed by N. Richard

Is steady employment the company's responsibility? Is such a fund as Al tells about practical for the plant? Is the plan fair to the new man?

All foremen are urged to discuss these questions vital to their work; of course the

discussion is not limited to foremen. Letters accepted and published will be paid for

Discussion of Earlier Topics

Preventing Spoiled Work

THE shop that does not help to train machinists, as well as apprentices, has no right to grumble when it collects the "duds" from other shops. It is not standing its share but is trying to let other people train men at considerable expense, to lose them later.

When boys are started no one expects them to have experience, but with men a certain groundwork is expected. In the case of Pete Wormser the mistake was so elementary that this could hardly have existed in his case, but, even so, very little supervision and a word or two would have remedied his error after one shaft had been scrapped. The sub-foreman should have given this instruction, for, either Pete was a new man and therefore to be watched as a somewhat unknown quantity, or else he should have been classified as comparatively inexperienced. In either case supervision is there for the purpose of teaching. —C. NORMAN FLETCHER, *England.*

Gang Bonus in the Shop

GROUP bonus, paid to everyone in a group or department according to the efficiency of the group as a whole, has come into popularity because it is considered easier to install than individual bonuses. It has given satisfaction in many concerns, but should not be adopted without careful consideration.

If operators, whose jobs are unrelated, are grouped together and rewarded according to group performance, there is danger of poor operators profiting from the hard work of others, or of good operators losing their reward because of the poor ones.

The essential equirement for gang bonus is, therefore, that all members of a gang or group have their work related or be selected for similar working capacities. It is best to use individual bonuses unless both these conditions exist to a considerable degree.

—SIDNEY TAIZ.

FOR the past four years the Hoyt Electrical Works of Penacook, N. H., employing 200 to 300 hands has successfully used the gang bonus, and the individual piece work plan. We pay gang bonus to different groups for completed, inspected instruments. Many members of the group have different guaranteed day rates, yet all receive equal pay. It works satisfactorily, because, when an operator has his quantity of parts out, he helps the others, and it has been noticeable that those inclined to let others do more than their share are soon forced to "come across" or be weeded out of the group. When it is demonstrated to the group that they can get proper adjustment for lack of stock or machine trouble, they will make good, and be pleased because it is team work. If one is sick, his pay does not stop; the group carries him for a reasonable time and thus acts as a sort of health insurance. All of which tends to promote good feeling. —CHARLES H. WILLEY, *Ass't Plant Supt.*

THE · NEXT · TOPIC

Letting a Big Order Go Elsewhere

ADVANCE QUESTION

Williams turns down a big order because he cannot get men enough without hiring them, temporarily, from other plants. Ed doesn't see why he shouldn't. Al agrees with Williams. Where do you stand?

The Foremen's Ideas on Pensions

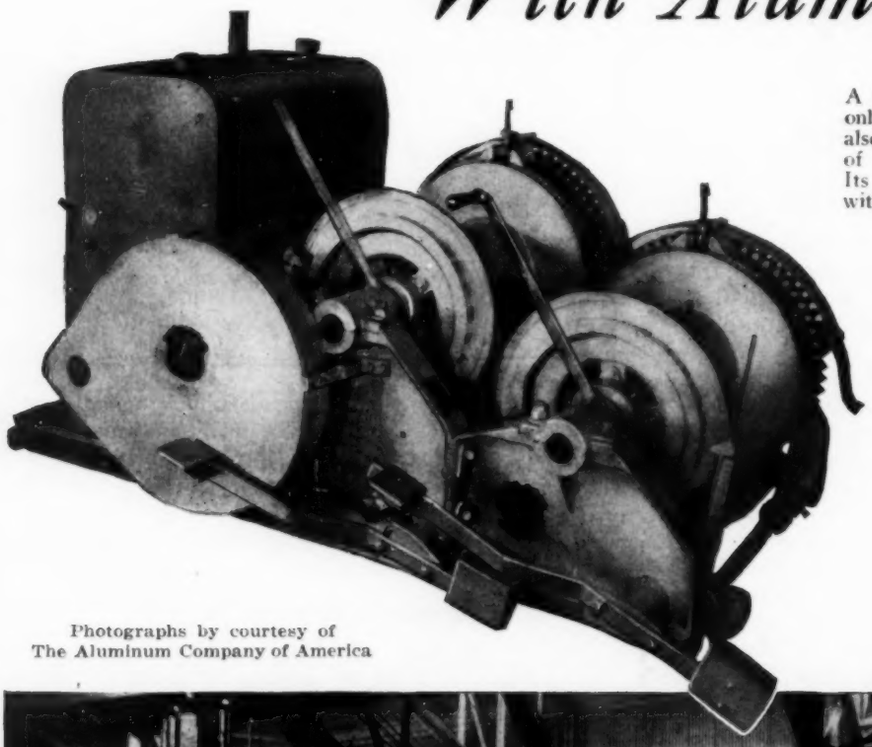
IN MANY vocations, especially among government or civil service positions, a pension is provided after a number of years of service. Such pensions are taken as a matter of course; they are accepted as an appreciation of faithful service, without any thought of charity. The holder of such a position receives a fair living wage, he acquires a certain prestige, and he is steadily employed without fear of discharge due to business fluctuations. He usually receives a vacation with full pay, and in addition to all this, he is pensioned when his term of greatest usefulness is ended.

Why, then, should not the industrial worker receive the same benefits? Is not his struggle for existence just as hard, or harder? Is not his employer just as dependent upon his knowledge, or skill, or brawn? Are not his chances of unemployment just as great, or greater? —R. H. KASPER.

I RATHER think that despite the obvious good of a pension system such as is suggested, Ed is right in urging that the men prefer to handle their own savings. Somehow, the pension system suggests paternalism, and the average worker resents the idea, particularly when he is made to contribute to it without exercising any choice in the matter.

I would rather favor a scheme which would encourage insurance with regular insurance companies, on endowment policies. The company may show good faith by paying premiums on a certain amount of insurance providing the worker carries a certain minimum on his own. The company policies would of course remain in effect only as long as employment was continued. In the case of lay-off without delinquency, the company might permit the employee the option of continuing the policy in his own name. —A. L. JANES.

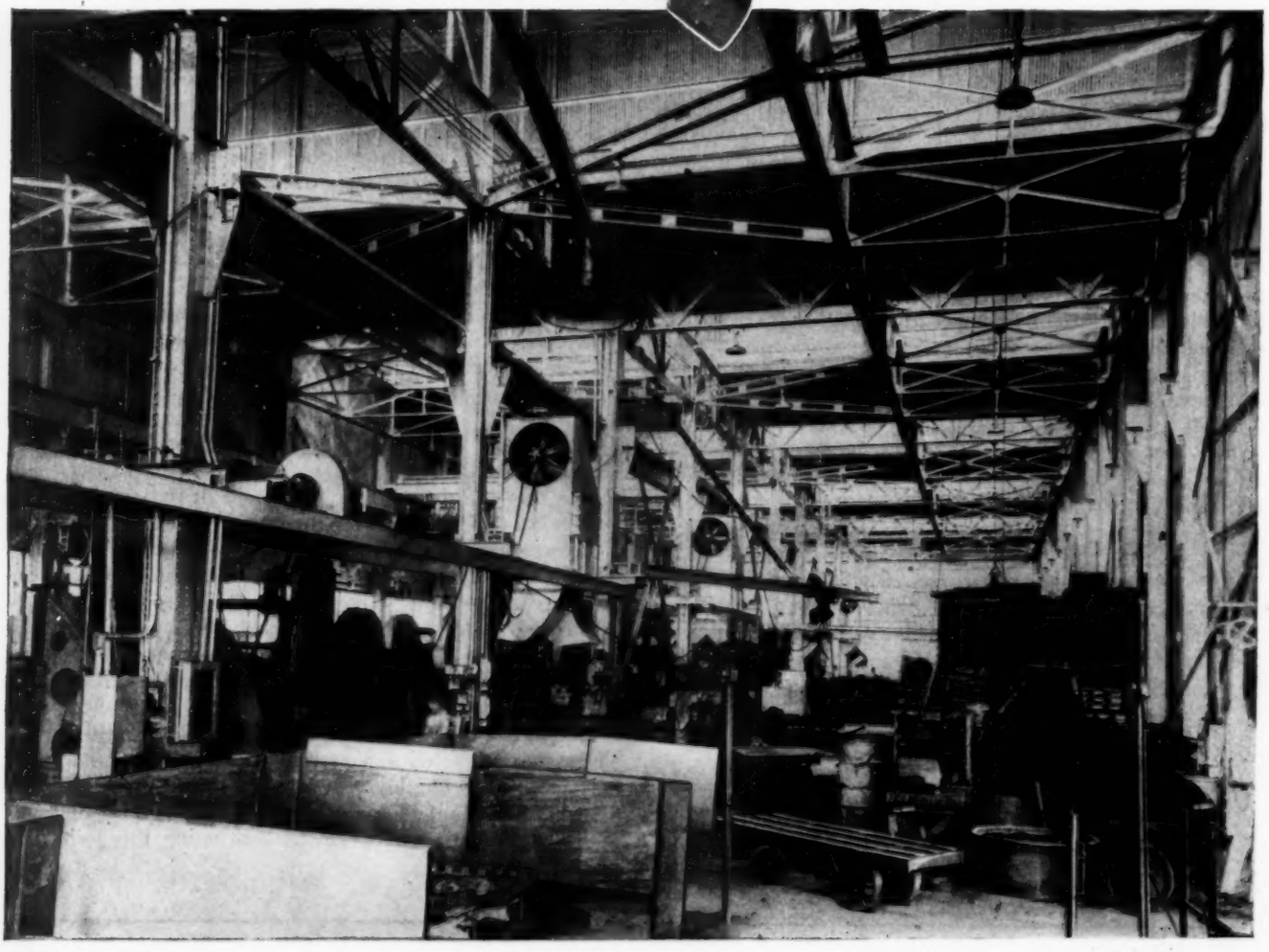
"Brightening Up" With Aluminum Paint



A bright "coat of metal" on this hoist not only protects the hoist from corrosion, but also eliminates one more dark, non-reflector of light in the shop where it is installed. Its manufacturer paints 41 types of hoists with aluminum paint

Photographs by courtesy of
The Aluminum Company of America

The uniform soft light filling this shop aids production, and the silver color of the aluminum painted steel work and walls is pleasing and claimed not to be tiring to the eyes of the workmen. Aluminum paint reflects 70 percent of the light energy that falls upon it and, therefore, tends to keep surfaces on which it is used cool as well as bright



Front-Axle Operations in the *Lancia* Shops

By J. A. Lucas

Illustrating and describing a few of the more important operations together with the fixtures and methods used in the fabrication

FRONT axles are awkward forgings to handle in fixtures and on machines because of their weight, length, and irregular shape. The Lancia bus axle is approximately 50 in. in length and is of heavy I-beam section, with the usual bevels that allow for draft in the forging dies. The sequence of the principal operations is given to the shop on standard operation sheets. The design differs from American practice in having the spring located between side flanges which assist in maintaining alignment when the springs are subjected to side stresses.

Both steering spindle holes are drilled at one setting in the permanent fixture shown in Figs. 1 and 3. This fixture is positioned at the back of a radial drilling machine so as to leave the drilling arm free for use over the table on any other work, between axle drilling operations. This fixture has four standards that are grouted to the floor, the two end stands having heads that carry the centering and clamping devices shown in detail in Fig. 1. The sectional view shows the centering jaws *A*, these being operated by the coned plunger *B* that spreads the back ends apart as the cone moves forward between the rollers shown in the ends.

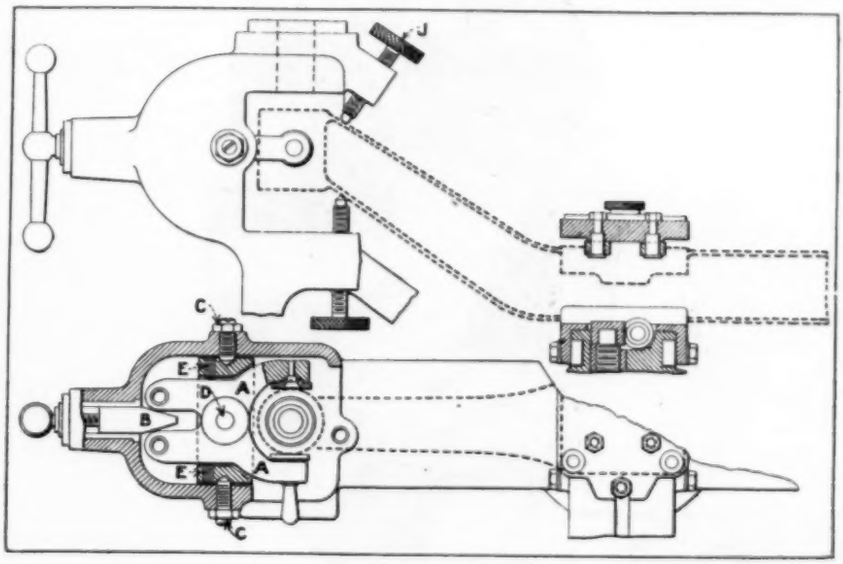


Fig. 1—Details of the centering and clamping devices used in the fixture for drilling the axles for steering spindles and for spring holding bolts. The work is done on a radial drill

These jaws turn about a horizontal axis formed by the cone pointed screws *C* Fig. 1, to permit ingress or egress of the axle end. The springs *E* open the jaws as the cone *B* is withdrawn. After being centered, as indicated, the screw *H* is brought up against the under side of the axle and the top held by screw *J*. Clamped and supported in this way the spindle hole can be drilled, reamed and faced, using supplementary bushings in the upper side of the fixture. The handle on the front jaw *A* is simply for ease in moving it down on the trunnion *C* to allow the axle to be removed or a new one put in place.

With the axle still in the same fixture the five holes are drilled in each spring pad, using the drill bushing plates shown. Details of the construction of this part of the fixture are seen in both Figs. 1 and 4, where the support for the axle is pulled forward, in loading position, ready for another axle. The centering clamp is dropped to its lower position to allow the end of the axle to be removed. The handle on the side of the outer jaw is for convenience in moving the jaws to either the clearance or the clamping position. The axle rests on the double tapered roller in the center of the supporting block. The spring seats, or recesses, are cut with a vertical milling cutter on the machine shown in Fig. 2. The method of locating the axles, by centering the ends of the steering spindle boss, is shown in detail in Fig. 7. Two brackets, a right- and a left-hand, are bolted to the milling machine table. The axle is put in place with the vise jaws at each spring seat, both to hold the axle firmly and to take the thrust of the milling cut. At the upper end of each bracket is a swiveling or centering clamp that positions the upper end of the axle, and insures the alignment of the spring seat and the steering spindle. An adjustable stop behind the steering spindle boss, shown at *A* in Fig. 7, helps to center the end of the axle and to hold it in place.

A scale at *B*, in Figs. 2 and 7, makes it easy to adjust the axle centrally with regard to its length, and so divide any inaccuracy as to the location of the spindle hole, in the boss at each end. The large size of the bore is to accommodate anti-friction bearings.

For profiling the ends of the axles so that the steering knuckles may swing freely, the formed cutter shown in Fig. 5 is used, the work being done with a simple

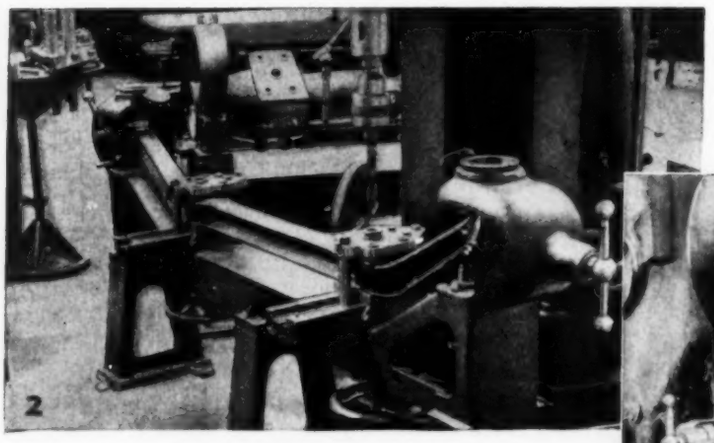


Fig. 2 — Stationary fixture for drilling both ends of the axle and the spring seats. The axles are carried on small blocks that slide under the bushing plates

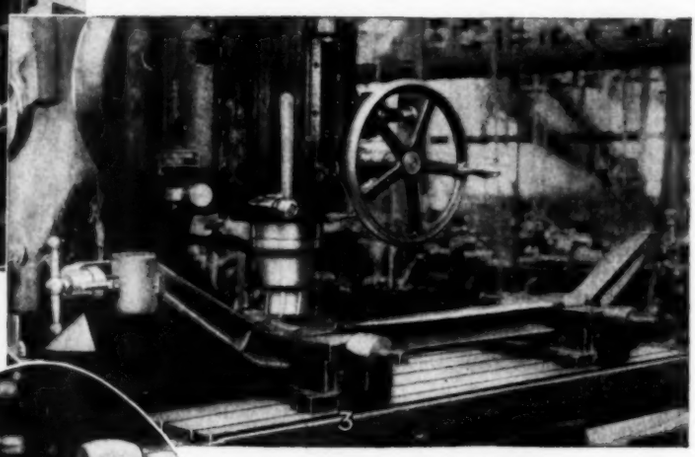


Fig. 3 — Milling spring seat in axle. Axle is centered at the ends by a floating clamp and held by a vise directly under the cut

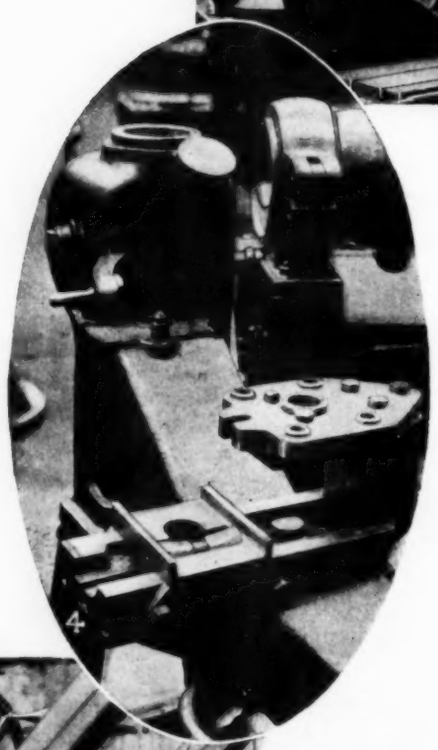


Fig. 4—One end of the axle drilling fixture showing the double tapered roller that supports the work in the block that slides under the bushing plate

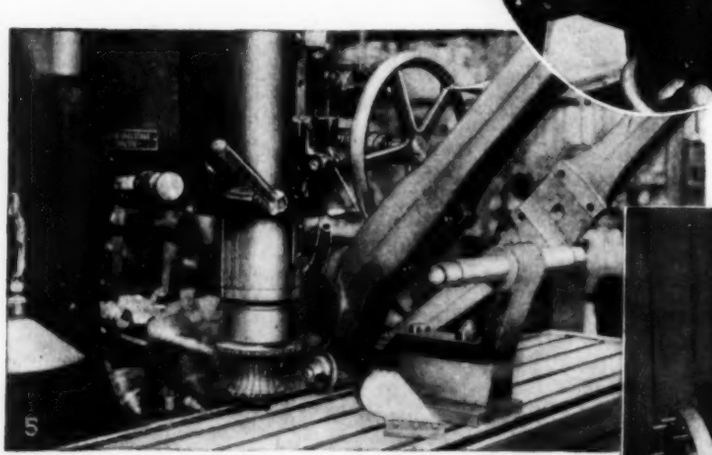


Fig. 5 — Profiling the ends of two axles with a formed cutter on a vertical spindle milling machine. The gage aids in setting the axles to the cutter

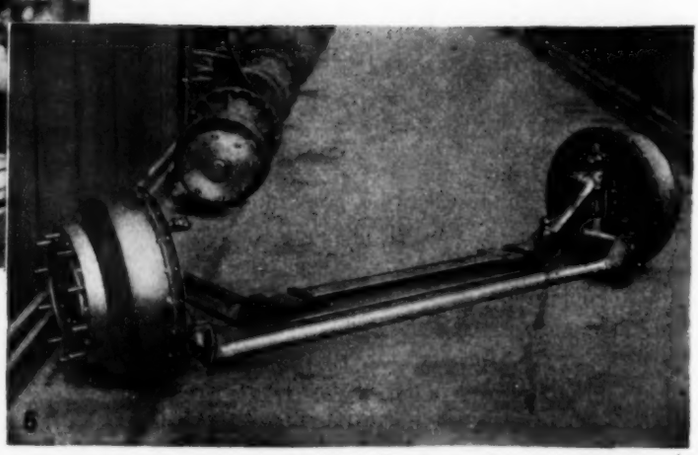


Fig. 6 — Complete front axle with steering knuckles, enclosed brakes, steering arm, and drag links

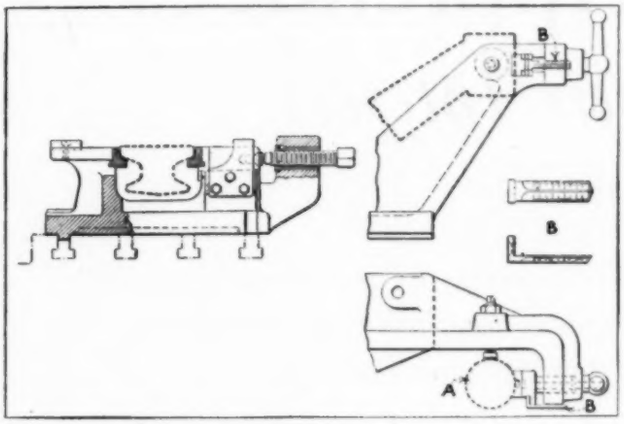


Fig. 7—Details of fixture for milling the spring seats showing how the ends of axles are centered and the forging held under the cut

fixture on a vertical milling machine. Two axles are milled at one setting, the fixture having a double-ended stud which permits two axles to be bolted in place at once. The only support is the cross-bar at the top of the fixture. The gage on the table is for setting the cutter spindle at the proper height with relation to the studs on which the axles are supported. This view also shows the four holes drilled in the spring pad for holding bolts and the recess in the center for the bolt that holds the leaves together. Turning the axle over allows the other side to be milled, the two axles giving a complete operation at one setting.

A completed front axle, with steering knuckles and brake drums mounted, is shown in Fig. 6. As will be seen, the brakes are well enclosed. Both the steering arm on the right and the drag link and its connections, are shown.

Standardization of Small Machine Parts

By Tom Addison

MACHINE builders in general are interested in standardization with its far-reaching possibilities of reducing costs and inventory. Nevertheless, when standardization is mentioned most men immediately think in large terms, rarely in small details. It is the possibilities of the latter which I want to emphasize.

Thoughts of the range of sizes of machine tools, and of units for machines are ever in the mind of the designer, but the minor details usually depend only upon a collection of miscellaneous items listed in "stock books," "standards' books," or whatever term the individual company may have for its lists of bolts, nuts, washers, setscrews, taper pins, etc. Some companies do not even have these helpful lists, although a number of firms have spent a large amount of money on this elementary, but necessary form of standardization.

Outside of the above-mentioned details designers drift into the habit of expecting their own plant to produce any part that may appear on their detail drawings. This habit is expensive and unnecessary, for a special bolt can hold up delivery of a machine tool just as easily as a special casting, if overlooked in the rush of delivery.

It is the writer's desire to call attention to the fact that other companies can frequently produce and sell details cheaper and just as accurate as they can be made in the home plant. These can readily be used in the product, releasing their own equipment both in office and shop to better advantage.

When drop forgings are mentioned, for instance, the cost of dies immediately rises as a tremendous argument against their use, especially when only a limited quantity will be used per annum. Nevertheless, there are companies producing drop forgings, and even finishing them, who publish catalogs of these various products which can be bought cheaply in small quantities. Companies making a specialty of drop forgings for the automotive industry produce quite a number of details, and some of the more wide-awake machine-building companies are using some of these to advantage.

Standard Stampings Are Available

Stampings come under the same heading. Sheets with louvres can be obtained readily in certain limited sizes, and they make a very neat appearance on any machine where the circulation of air is desirable. These louvred doors are much cheaper than cast-iron doors with their necessary hinges and fittings. Arbor collars come under this same heading. These can readily be obtained to accurate limits of thickness, and with varying inside and outside diameters. Standard steel tubing could possibly be used to greater advantage in the design of details, especially in levers and the like.

Bronze bushings are now available in all varieties of dimensions, oil grooved to suit individual tastes. Use of these bushings eliminate drawings and patterns, and with their cost reduction provide a greater margin of profit.

Locknuts are designed in a great variety of shapes and sizes. A standardized list of locknuts and washers produced by leading ball bearing manufacturers are now on the market. Although originally intended for the holding of ball bearings their use has spread to the holding of many other details than those originally intended. Another firm produces a very efficient line of shaft collars, solid steel with hollow hexagon setscrews.

Going to more extreme cases we find hardened spiral bevel gears listed by a leading company. These have been used by the writer in special drives, giving a smooth action at greatly reduced cost.

Clutch plates and facings are also available when a standard design of clutch cannot be used. At least three companies produce and advertise a very efficient universal joint, these having been originally developed for their own line of machines. Instances are also on record in the machine-tool industry where die castings are being utilized.

Finally, bushings for jigs and fixtures can be obtained readily in large or small quantities, eliminating a large amount of toolroom work, heat-treatment, and the like, which, in the average shop, is expensive. Many companies are taking advantage of these details, especially as immediate delivery is assured, the workmanship is accurate, materials are of the best, and the cost is lowered in the machine being built.

Contests for Apprentices

Stimulate Their Interest

By C. J. FREUND

Apprentice Supervisor, The Falk Corporation

Two years of experience with apprentice contests by the Apprenticeship Committee of the National Metal Trades Association of Milwaukee has proved their value beyond question

ORDINARILY, a mature machinist dislikes change. If he gives up one job to look for another, he does so against his inclination. There is nothing he likes better than steady work with regular working hours and established habits. He becomes nervous when his foreman says anything to him about a different machine than that to which he has become accustomed. He opposes all variety and excitement.

It is altogether different with apprentices. Their spirits are not yet settled. They have had little experience, and have seen just enough to let them glimpse additional opportunities. They are inquisitive, fearful that they will lose, and, hence, anxious for changes of work and environment. They crave variety and excitement, which add zest and interest to the job.

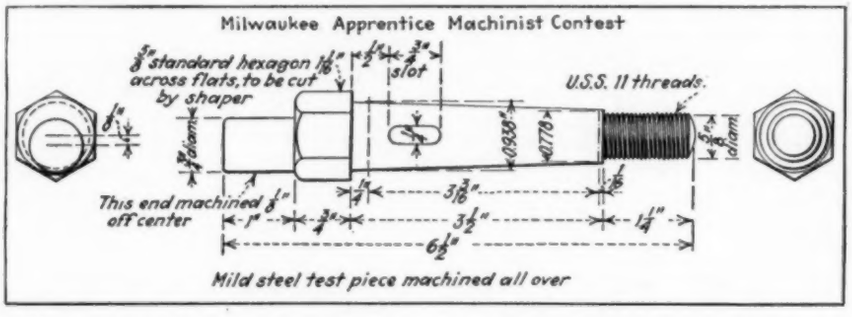


Fig. 1—The 1927 contest, which involved making the part illustrated, brought out valuable information, for the apprentice employers, on points at which their apprentice training was incomplete in the use of certain machine tools. Many of the contestants had difficulty shaping the hexagon nut shown. The work had to be completed in 8 hours

Successful administration of apprentice training is not merely a matter of carefully planned work and pay schedules, skillful hiring and thorough supervision. It must take into account the boys' restlessness and craving for variety, and must satisfy these tendencies. Of course, a well-planned work schedule provides frequent changes of work, but these changes are anticipated by the apprentices and, too soon, become a part of their daily life. More interesting features must be worked into the apprenticeship program if their enthusiasm is to be maintained.

The Apprenticeship Committee of the National Metal Trades Association of Milwaukee has arranged dinners, speakers, special motion pictures, and other entertainment in order to maintain the interest of over nine hundred apprentices in the member plants. Most effective in this direction, however, has been a series of annual contests for apprentices in four of the most important trades, conducted by a special sub-committee of the Metal Trades Apprenticeship Committee.

The first step in arranging one of these contests is to draw up a set of governing regulations to specify, precisely, what is meant by the term "machinist apprentice," and thereby establish a measure for eligibility. The following steps in organizing deal with the prizes to be awarded, the problems to be given, and by whom they are to be selected: Who shall provide the required material and equipment, how shall the judges be selected, and upon what standards shall they judge? What is to be the proportion of apprentices to compete from each member plant, what method of marking the work other than by names of the contestants shall be used, under what conditions shall the contest work be done, and what should be the place and time for the contest? Fortunately, the regulations need to be made but once, although minor revisions may be necessary from year to year.

The contest includes a two-hour examination in mathematics and trade subjects. The second task for the sub-committee is, therefore, to determine the general nature of this examination, and to select problems for each of its divisions. Each member is given a certain time, usually a week, in a meeting held for this purpose, to send in to the chairman a full set of suggested jobs and problems for the contest. A second meeting follows at which the entire sub-committee goes over the material submitted and chooses those parts which are to make up the contest and the examination.

In the 1927 contest, each competing apprentice was required to make the piece shown in Fig. 1, within eight hours, from round, cold-rolled stock without assistance. He was also required to grind the needed tools himself.

The piece was designed for the contest, which called for an all-around test of skill on small machine work. In 1928, the sub-committee on contests felt that the 1927 job had favored, somewhat, the apprentice who had spent most of his time on small pieces. It therefore arranged a contest in tool grinding in order to give a similar slight advantage to apprentices more familiar with the heavy type of tools. The problems are shown in Fig. 2 for the 1928 contest.

After the problems have been chosen, the sub-com-

mittee estimates the number of apprentices who will compete in order to determine the cost of material required. The estimate is based upon the number of machinist apprentices reported by the members of the association and the percentage to be admitted from each shop. So far, one apprentice has always been admitted to the contest for each ten, or fraction of ten, on the payroll at the time. The cost of the prizes is added to the cost of material.

The contests are held in the machine shops of the Milwaukee Vocational School, which is equipped for such an undertaking. The director and officials of the school and the instructors in the machine shop have played a large part in the success of the venture.

A delegation from the subcommittee goes to the school and makes the necessary arrangements for examination rooms, for instructors to supervise the work in the machine shop, and for delivery of the necessary material. The instructors, who are to take charge, are given a copy of the governing regulations. In addition, the instructor in general charge, receives from the secretary of the Association a list of names of contestants and corresponding marks for the specimens, usually numbers, which remain confidential between them until after the judges have selected the winners.

This done, the secretary of the Association sends announcements to all members, telling each one how many apprentices he may enter and inclosing extracts from the regulations. A form is also inclosed upon which to report the names of those who will represent the member. The work to be done is not divulged beforehand.

Each member of the Association is free to select contestants in any way that suggests itself. Some shops hold competitions of their own for this purpose. Other shops send those apprentices who are recommended by the superintendent or a representative group of foremen, and in others again, they are named by the apprenticeship directors. In certain plants, the school work, shop work, and deportment of the apprentices are graded at regular intervals and the leaders thus chosen.

When each plant has reported the names of its representatives, a letter is then written to each contestant, telling him the day and hour he should report to the school, the tools and equipment he must bring with him, and the regulations which apply to the contestants, especially the one stating that he shall work without assistance from anyone, nor communicate with anyone except members of the committee or instructors. When the contestant arrives at the school on the morning of the day appointed for him, he finds machines and equipment in readiness for him to begin work. A regular class is in session in the room. The instructor in charge of the class is, at the same time, the supervisor of the contest. The instructor warns the contestant in the matter of the regulations, gives him a statement of the problems to be done, points out to him where all necessary tools and materials have been placed, and directs him to begin work. The contestant mingles with the class, but he has the first right to all machines and equipment in the room. He selects the tool stock to be used, and must grind his own tools. The instructor keeps time, if this is necessary.

At the end of the day the contestant is required to turn in to the instructor both the specimen and the blueprint from which it was made. Of course, the apprentices who have completed the work may describe the job to their friends, if they wish, and may even be tempted to make a sketch for their benefit from memory. However, experience has shown that the ordinary contestant is unwilling, in the first place, to give much assistance to another who might thereby beat him to a prize, and in

MACHINE APPRENTICE CONTEST

NATIONAL METAL TRADES ASSOCIATION

PROBLEM NO. 1

Grind tool for roughing down a 30" manganese steel gear with scale, 1/2" depth of cut, 1/16" per revolution feed and 40' per minute speed.

PROBLEM NO. 2

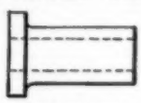
Grind tool for finish turning the same gear, 1/32" depth of cut, 1/64" per revolution feed and 50' per minute.

PROBLEM NO. 3

Grind tool for finish planing cast iron, 1/64" depth of cut, 1/8" feed, 32' per minute speed.

PROBLEM NO. 4

Grind tools for boring, roughing and finishing brass bushing, outside diameter 4", as shown in sketch. Finish all over including radius.



PROBLEM NO. 5

Use same sketch as above and grind tools for cast iron for boring, roughing and finishing.

PROBLEM NO. 6

Grind tool for planing slot in steel block 1/4" wide, plus or minus 1/16", slot to be 1/4" deep.

PROBLEM NO. 7

Grind turning tool for finishing taper end on bronze bar using tailstock set over.

PROBLEM NO. 8

Grind turning tool for roughing and finishing cast iron bar 3" diameter, 12" long.

Fig. 2 — Grinding made up the contest work for the 1928 apprentice contest. It may interest many men, who have long ago passed the apprentice stage, to try their hand at answering these questions

the second place, most apprentices in the contest are so intent upon the work and undergo such complete mental relaxation when it is finished that they are not able to give out information that would be of much assistance to anyone else.

While the contest is in progress, the sub-committee selects the board of judges and confers with them regarding their duties. Men are chosen who are particularly well qualified to judge. Thus, the board of judges for the job shown in Fig. 1 was composed of three inspectors. The chairman of the board was chief inspector in a large machine shop. The judges of the tool-grinding contest, shown in Fig. 2, were equally qualified. Two of them were apprentice instructors in machine shops, and themselves mechanics and toolmakers. The third was a machine-shop superintendent.

The points upon which the work is to be judged and the percentage to be assigned to each point are determined by the judges, if this has not been done by the sub-committee on contests. Each judge is given a score sheet, and when each has completely filled it out, the chairman strikes an average that determines the winners. The judges report these winners by their specimen numbers for first, second, and third places to the secretary of the Association.

The prizes are awarded at the annual banquet given by the Association for all senior apprentices and shop officials of the district. The toastmaster calls the winners to the speakers' table and gives them the prizes and congratulates them in public. The public nature of this recognition is a distinct triumph for the winners, and also stimulates the less fortunate apprentices to make greater efforts in the next event.

The contests have a favorable effect upon all the shops in the district. Besides writing to the winners, the secretary of the Metal Trades Association issues a general letter to all the members, giving the results of the contest. This letter includes the names of the winners and the judges, the problems, the ratings of all contestants, both in total and under each item, and a statement of the working conditions.

Both this letter and the announcement of the winners are awaited with much eagerness by apprentices, mechanics, foremen, superintendents, and executives in the shops of the Metal Trades Association. There is keen rivalry between apprentices in the individual plants, and between the plants in the district.

Frequently, the employer gives a cash prize or other reward to the successful apprentices in addition to the prize given by the Association, and almost invariably a local dinner is given, or some other celebration is held in their honor. It is needless to point out that all this has a favorable effect upon the morale of apprentices in all the plants.

Moreover, the contests have a distinct instructional value. Both the instructor in charge and the judges who examine the specimens write a critique of the work done by the contestants, which is sent out with the general letter announcing the results and which calls attention to the favorable and unfavorable features of the workmanship and mental attitude of the contestants. It is assumed that these contestants are the best apprentices in the district, and whatever excellent points their work may have, must be the result of a general tendency in the training work of the district which should be further developed.

On the other hand, whatever weakness they may display, must be due to a deficiency of instruction common to the shops in the Association. For instance, the hexagon in Fig. 1 was required to be made on a shaper, and while it was a rather difficult task for an apprentice, there were evidences of general weaknesses in the skill of the contestants on this machine. As a result, more attention is being paid to the shaper in all shops and the shortcomings are being corrected.

The contests have a further value in that they stimulate the interest of the parents and friends of the apprentice. The success of an apprentice depends, much more than is ordinarily appreciated, upon the support and encouragement of those with whom he is intimate, his relatives and friends, his former teachers, the influential men of his neighborhood, and most of all, upon his parents. Educators understand this influence very well, and in all schools contact with parents and friends is skillfully maintained by means of plays, debates, concerts, and other entertainments and activities in which the students take part.

Apprentice contests are the most successful means yet devised for stimulating the interest of parents and friends in a similar manner. The successful contestants are urged at home to continue their excellent work. Other apprentices are induced to prepare for a better showing in the next contest. This alone would justify these competitions in trade skill.

Now for the Pickling Room

FEW executives are as proud of their pickling rooms as of the rest of their plants. Not many visitors breathe the fume- and steam-laden atmosphere, or walk the sloppy floors that are often found in these departments. Some of the things that can be done to improve these conditions and to make pickling more of a production operation than it is in many plants will be described in next week's issue

Locomotive Driving Box with a Floating Bushing

The usual crown brass is discarded and is replaced by a full-floating bushing similar to those used in the back end of main connecting rods

BEARINGS and their lubrication form one of the serious problems in the design and maintenance of locomotives, as well as of all other classes of machinery. From the beginning of railways, practically all axle bearings have consisted of some form of shoe by which the load is supported on the axles. These have been called brasses, and the bearings in the driving boxes have been known as crown brasses for many years. Many forms have been tried. Some shops cast crown brasses in place in the driving box, but the great majority continue to make them separately and force them into a machined seat or recess in the top of the driving box casting.

The Canadian National Railway is, however, experimenting with a radically different type of driving box, as can be seen from the illustrations. Instead of the usual driving-box casting, with its open jaws to go over the driving axle, the new box, which is patented, is made in two parts that surround the axle completely and carry the same type of bearing as that found in the back end of the main connecting rod on many of the newer locomotives.

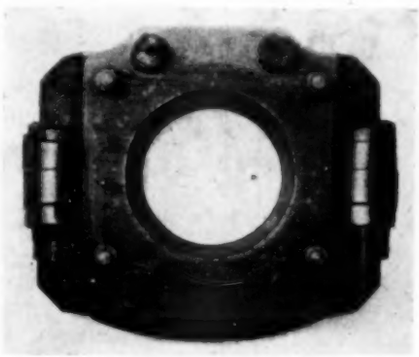


Fig. 1—Assembled driving-box with floating bushing instead of crown brass and oil-cellar as usual

The appearance of this box when assembled is shown in Fig. 1. In general it consists of a split cast-iron liner held against rotation by a flat key, and clamped between the two halves of the driving box by four bolts. Inside the stationary liner is a bronze bushing also split, but not held against rotation. Details of a 10x 12-in. driving box can be studied to advantage in Fig. 2. The box itself is composed of two substantial steel castings *A*, with four clamping bolts widely spaced. The stationary cast-iron liner is shown at *B*, and the bronze floating bushing is at *C*. The brass wearing plate is shown at *D*. The principal dimensions of the parts are given.

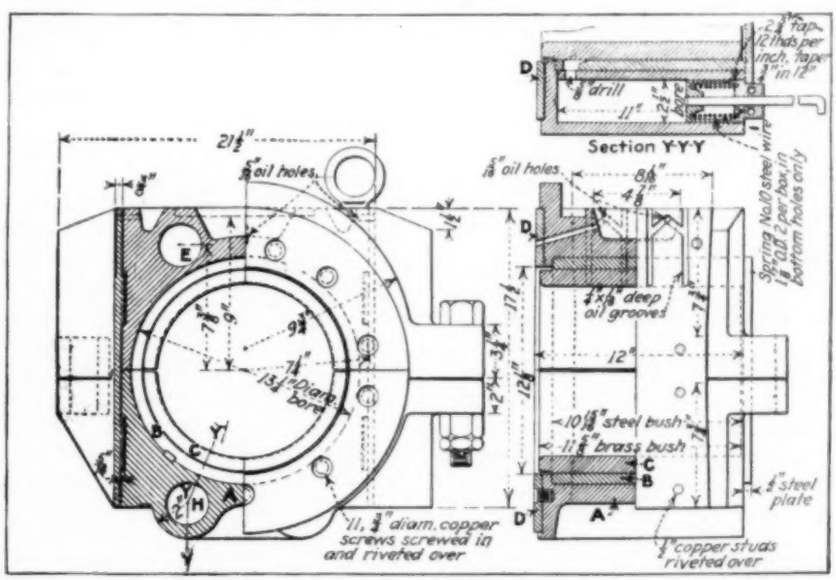


Fig. 2—Details of two-part driving box with floating bushing. This box has been designed on the same plan as the solid end main connecting rod with a fixed bushing in the box and a floating bronze bushing on the axle. Four grease pockets are provided

One noticeable difference between the new driving box and the types with which we are all familiar is the absence of the cellar for holding the waste and oil. Lubrication, however, receives careful attention, as four grease pockets or reservoirs are provided. Two of these pockets are at the top of the box, as at *E*, and two below at *H*. These are 2½ in. in diameter, the upper holes being about 10 in. long and the lower ones about 7 in. in the clear. The difference is caused by spring-actuated plungers being used in the lower reservoirs to force the grease up to the axle. This method of feeding is not considered necessary for the upper reservoirs.

The sectional view shows how the stationary cast-iron liner *B* fits into a recess, and does not extend quite the full length of the driving box. This view also shows the brass wear plates *D*, which are held in position by ⅝-in. copper screws whose heads are riveted over into a countersunk recess. Six screws are used in the upper half of the plate, and five in the lower. On the other end of the driving box is a plate that serves as a dust guard, as shown at *J*. This is a square plate with rounded corners, and is cut diagonally instead of at the parting line of the driving box itself. Two ¾-in. eye-bolts, located at diagonally opposite corners, are provided for handling the driving box with a crane. Details of both the stationary and floating bushings are shown in Fig. 4. In the fixed bushing, it will be noted that the mating surfaces

of the two halves are machined before the bushing is turned and bored, so as to present a continuous surface to the floating bushing. The floating bushing is, however, turned, bored, and drilled in one piece, and then split by a $\frac{1}{16}$-in. saw-cut on each side. The corners are rounded, and the inside edges are relieved slightly for a distance of $\frac{1}{4}$ in. from the parting line. Oil grooves have been very carefully laid out in the stationary bushing, the hole and passageway, connecting them with the reservoir, can be seen in both Figs. 3 and 4. The floating bushing is drilled radially in staggered rows. The holes are $\frac{5}{16}$ in. in diameter and are slightly countersunk on the inside, so as to remove any burr. On the outside they are countersunk to a depth of $\frac{1}{4}$ in. Two holes are provided in each half of the floating bushing for $\frac{1}{2}$-in. eye-bolts, as an aid in handling them.

Fig. 3—Half of driving-box, with fixed cast-iron liner at the left and the brass floating bushing at the right

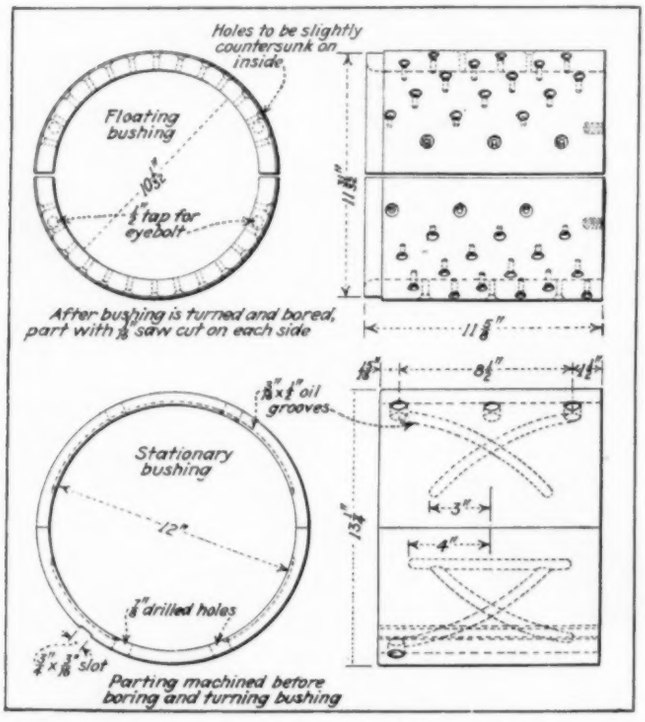


Fig. 4—Details of the cast iron stationary bushing and of the bronze floating bushing. The iron bushing is made in two parts, with the edges machined before boring and turning, so as to present a continuous surface

Silicon-Bronze Offers High Strength and Corrosion Resistance

COPPER-SILICON alloys, containing up to a maximum of 6.7 per cent silicon, are shown to be very resistant to corrosion and to acids, in a paper presented by H. A. Bedworth of the American Brass Company, at the annual meeting of the American Institute of Mining Engineers held in New York, February 18-22. The maximum solubility of silicon in copper is at 6.7 per cent, but the alloy is too hard at above 3 per cent silicon for ordinary use. The additions of manganese considerably improves the working qualities of the alloys. In general the addition of silicon and manganese is one of the most effective means of hardening copper known.

The ratio of silicon to manganese is kept at 3 to 1. With 3.17 per cent of silicon the Rockwell hardness is 102, which can be reduced to 25 by annealing at 750 deg. C. for 30 min. and air cooling. Hard-drawn alloys have a tensile strength up to 155,000 lb. per sq. inch.

Adopting the New

By R. H. Kasper

IN PERUSING the pages of an old mechanical book, I encountered an article on the use of belting which impressed me as being of particular interest. The article, dated in the year 1837, was written at a time when the use of belting as a power transmitting agent was being urged.

The author begins by stating that at that time it was thought by engineers in general that mills could not be run effectively without "large and ponderous lines of vertical and upright shafting of either cast or wrought iron, and heavy trains of cog-wheels of cast iron or partly of iron and partly of wood."

He went on to say: "And when large leather belts began to be introduced for the main gear of mills, as a substitute for gear wheels, it was thought by some of our best engineers to be an experiment, at the least, of very doubtful result, if not altogether impracticable; and, indeed, at the present time (1837), notwithstanding all the evident advantages of belts over gear wheels, many still adhere to the old mode of gearing." This hesitancy to adopt anything new seems to be a trait of mankind, which, in the present-day tendency toward direct electrical drives, is being manifested by some belting enthusiasts who consider the belt drive the most desirable for all purposes.

The author then goes on to state that the first cost and maintenance cost of belt drives will be as little as with gear wheels; that if a belt breaks, it is but the work of minutes to repair or replace it, as compared with hours lost in the case of gearing, and that should a change of velocity be desired later, the cost of making the change is far less. These statements, although hard to believe by the engineers then, are commonplace now.

The author further continues by stating that to gear a mill properly with belting requires "more nice calculation, careful judgment and practical experience than to do it with gear wheels." The present-day mechanic or millwright would probably disagree with this statement, as one of the main claims in favor of belting is its simplicity. The whole thing, viewed now after nearly a century, possibly shows that if the advocates of change were not so inclined to exaggerate the possibilities of the new and to condemn entirely the old methods, they would stand a greater chance of having their ideas adopted more readily.

Automotive Sales Abroad

By W. E. IRISH
Research Editor, American Machinist

In the sale of motor vehicles is reflected the need for many other metal products in foreign countries

THE MOTOR vehicle is essentially an assembly of metal products, from its chromium-plated radiator cap to its spring-steel bumpers. Its designers draw upon nearly every division of the metal-working industries. Its manufacturers constitute a major metal-working group which looks to other metal-working plants for equipment, materials, tools, and instruments necessary to production. The readers of the *American Machinist*, both in these motor vehicle plants and in plants of other divisions of metal working, will therefore, be interested in the present world status of the motor vehicle.

Data on this present status are provided by the *American Automobile* in its March edition. It was shown that total vehicle production, including cars, trucks and buses, for the United States and Canada for 1928 amounted to 4,600,415. This was a gain of 1,020,013 over 1927 and 135,225 more than the previous record year of 1926. In fact, the 1928 figures are not actually completed, as a certain amount of production for the last few weeks of the year was not known and few overseas assemblies are included. Therefore, the final production figure covering the American industry will be higher than here shown. The data in Table I are the output figures for each month of the year, it being understood that the computation for December is incomplete, thereby making the totals tentative.

Exact European production figures needed to complete the world figure for 1928 are, unfortunately, not available at this time, but from estimates made by the *American Automobile* the 1928 output of all European producers approximated 600,000 units, including cars and trucks, as follows:

Great Britain	215,000
France	200,000
Germany	92,000
Italy	50,000
Czechoslovakia	12,000
Austria	9,000
Belgium	7,000
Switzerland	1,300
Sweden	1,100
Spain	750
Hungary	500
Denmark	250
Miscellaneous	1,000
Total	589,900

The European tabulation does not include the assembly or manufacture of American automobiles in Europe, these totals having been included under the American production figures. When the European total for 1928 is compared with the estimated 1927 figure of 574,000 units the increase in foreign manufacture is seen to be small.

Table I—Car and Truck Production in the United States and Canada in 1928

Month	U.S.	Canada	Total	U.S.	Canada	Total
	Cars			Trucks and Buses		
Jan...	205,646	6,705	212,351	26,082	1,758	27,840
Feb...	291,151	10,315	301,466	32,645	2,189	34,834
March	371,821	15,223	387,044	41,506	2,246	43,752
April..	364,877	20,517	385,394	45,227	3,694	48,921
May..	375,863	29,764	405,627	49,920	4,178	54,098
June..	356,622	25,341	381,963	40,174	3,058	43,232
July....	338,792	20,122	358,914	53,284	5,104	58,388
Aug...	400,593	24,274	424,867	60,705	6,971	67,676
Sept...	358,872	16,572	375,444	56,422	4,621	61,043
Oct...	339,976	13,016	352,992	57,136	5,520	62,656
Nov...	217,256	8,154	225,410	39,679	3,615	43,294
Dec...	205,144	6,734	211,878	27,991	2,691	30,682
1928..	3,826,613	196,737	4,023,350	530,771	45,645	576,416
1927..	2,946,601	146,182	3,092,783	454,725	32,245	486,970

A large part of the total American domestic production has found its market in the United States. A small number of units, comparatively, have been imported. At the same time very important expansion has been taking place all over the world, as comparative figures of Table II for various territories point out.

Outside of the American registrations, there are nearly 7,500,000 units registered in the world, which represent an increase, in the past six years of, 256 per cent. Here is not only an increase representing a remarkable expansion in the use of the car and truck, but it also indi-

Table II—Car and Truck Registration In Various Countries, 1922-1929

Country	1922	1929	Increase Per Cent
Argentina	75,000	299,839	300
Australia	89,191	515,851	478
Brazil	25,000	155,000	520
Canada	463,448	1,061,828	129
Czechoslovakia	4,133	49,151	1,090
Denmark	22,260	88,898	300
Egypt	5,084	25,720	407
France	287,188	1,108,900	285
Germany	91,384	545,100	496
Great Britain	497,582	1,372,109	175
Holland	13,500	85,500	532
India	45,983	131,500	186
Italy	53,000	172,000	224
Malaya	8,000	30,896	286
New Zealand	37,500	125,690	238
South Africa	26,468	125,850	376
Spain	37,560	156,501	316
Switzerland	18,011	61,000	239
United States	10,505,660	24,494,580	133
Uruguay	10,000	34,591	245
Venezuela	2,500	15,750	530
World	12,588,949	31,929,952	154
World less U. S.	2,083,289	7,435,372	256

Exports from the United States in 1928

COUNTRIES	PASSENGER CARS						TRUCKS						Parts for Assembly	Parts for Replacement
	Up to $1000		Over $1000-$2000		Over $2000		Up to 1 Ton		Over 1-2½ Tons		Over 2½ Tons			
	No.	Value	No.	Value	No.	Value	No.	Value	No.	Value	No.	Value	Value	Value
Austria	86	$47,150	51	$66,493	9	$20,084	158	$94,467	13	$11,283			$148,254	$143,515
Azores and Madeira	62	33,763	8	8,620	1	2,054	41	21,046	16	12,645			52	17,357
Belgium and Luxemburg	13,437	7,798,939	5,241	6,011,520	843	2,104,033	5,418	2,137,540	183	116,019	28	$23,497	1,032,751	4,342,041
Bulgaria	177	94,340	37	39,133	1	3,077	157	73,115	20	10,827	2	1,598	1,664	5,357
Czechoslovakia	307	189,129	172	196,343	36	76,331	47	29,281	20	21,524	1	988	39	79,610
Denmark	7,441	3,806,930	1,298	1,430,393	108	255,461	3,932	1,627,251	535	346,191	5	9,841	350,847	1,712,970
Esthonia	25	18,581	14	14,944			17	13,326	19	23,060			75	5,919
Finland	1,799	1,119,327	1,038	1,158,810	175	424,699	222	210,712	522	458,173	42	80,325	777	365,858
France	1,134	618,506	1,280	1,603,637	474	1,168,017	1,211	565,473	393	116,929			1,866,276	1,577,077
Germany	8,723	5,149,014	2,808	3,110,697	1,076	2,542,810	1,998	995,704	750	396,410	10	16,794	5,265,630	5,348,890
Gibraltar	9	5,485	3	3,310	1	2,141			1	960				410
Greece	1,609	814,355	387	412,244	39	93,586	703	370,503	348	212,862	2	3,200	3,928	187,735
Hungary	455	263,463	226	250,430	33	71,728	21	15,356	61	33,433			1,632	56,558
Iceland	44	28,328	26	34,792	1	2,560	9	5,348	14	10,127				15,720
Irish Free State	260	131,580	70	76,917			29	20,325	54	31,356			67,333	540,097
Italy	1,710	914,252	737	854,799	119	284,988	264	137,490	166	76,755			13,878	304,346
Latvia	39	22,094	9	9,910	1	2,036	35	31,761	29	27,313				17,676
Lithuania	48	25,629	44	50,951	2	5,849	6	5,850	10	9,870				3,803
Malta	96	61,606	55	56,320	1	2,141	20	8,730	10	6,968				14,528
Netherlands	3,493	1,882,428	1,219	1,370,733	227	518,678	109	101,051	372	311,370	20	58,266	21,247	846,395
Norway	840	581,490	506	566,302	49	116,664	234	193,227	252	331,262	55	162,488	546	224,286
Poland and Danzig	1,311	722,513	361	371,457	49	119,170	325	180,903	284	223,942	4	13,161	343,353	327,723
Portugal	1,079	594,501	447	491,871	68	163,926	652	358,408	222	238,347	3	5,343	2,102	121,852
Roumania	3,359	1,881,330	1,060	1,092,813	70	160,814	1,063	581,728	192	132,026	12	10,890	4,883	183,586
Russia (in Europe)	287	123,910	102	142,777	20	58,345	129	53,241	99	76,765	50	259,692	2,024	172,934
Spain	6,034	3,643,376	2,912	3,453,938	697	1,553,650	3,461	1,786,633	930	992,355	25	47,577	265,223	1,343,140
Sweden	14,124	7,115,666	3,756	4,008,302	346	840,313	6,071	2,910,177	750	749,647	129	112,529	15,645	886,905
Switzerland	1,433	1,012,723	1,095	1,271,087	179	389,782	5	3,903	20	21,583	2	1,564	13,466	150,610
Turkey (in Europe)														
United Kingdom	9,535	5,060,867	1,109	1,380,425	552	1,273,932	7,212	3,134,820	873	570,024	78	136,510	1,175,550	4,905,351
Yugoslavia	561	274,468	101	114,302	32	81,638	52	26,104	103	69,888	1	767	250	14,533
United States														
Canada	32,832	19,474,252	7,857	9,860,696	1,564	4,109,969	2,592	1,851,499	3,704	4,878,264	657	1,791,568	40,721,116	6,673,967
British Honduras	31	14,192	2	1,985			1	426	3	4,534			124	8,075
Costa Rica	139	97,738	228	250,781	20	41,051	89	70,042	104	131,357	4	18,006	3,282	61,692
Guatemala	130	75,131	203	242,071	86	190,374	92	56,545	172	310,618	5	20,974	11,017	112,497
Honduras	46	38,821	4	4,460	7	18,645	25	14,311	29	31,739	1	3,661	1,345	29,957
Nicaragua	59	32,272	57	68,108	4	7,157	11	8,129	14	19,533	1	2,968	1,551	26,309
Panama	1,085	533,183	327	359,981	28	62,952	84	51,203	316	248,113	11	38,254	5,764	374,766
Salvador	100	65,360	158	186,130	63	138,440	5	1,820	13	29,654	3	11,708	166	53,434
Mexico	11,273	5,681,917	1,361	1,681,442	207	571,987	2,045	999,445	1,089	1,228,199	140	367,936	884,830	916,446
Newfoundland and Labrador	296	176,023	85	96,627	2	5,397	43	14,808	6	7,601			1,509	24,761
Barbados	52	33,132	16	17,648			1	917	14	8,596	4	2,120	190	30,179
Jamaica	534	312,087	111	116,289	14	33,965	63	50,402	125	132,417	5	10,563	1,437	196,304
Trinidad and Tobago	144	95,074	44	43,168	1	2,050	35	26,579	39	33,846	1	2,883	285	50,053
Other British West Indies	241	96,441	9	10,078	2	3,600	54	17,822	33	24,502	11	14,028	2,911	58,268
Cuba	4,872	2,396,592	922	1,154,793	190	499,020	498	262,923	787	827,783	122	440,045	136,506	802,392
Dominican Republic	969	561,757	255	267,376	56	136,018	159	95,554	168	199,391	1	1,431	10,895	153,299
Dutch West Indies	159	86,203	100	110,855	8	16,584	85	61,282	49	43,522	19	52,538	402	64,679
French West Indies	130	74,414	15	7,047	1	1,861	43	24,396	14	8,114			1,453	13,374
Haitian Republic	156	94,949	79	90,087	2	3,614	48	36,257	56	55,326	3	11,303	564	62,656
Virgin Islands	88	30,332	7	11,067			7	4,851	6	6,800			920	13,331
Argentina	31,356	15,852,626	7,437	8,065,894	941	2,313,482	12,196	6,323,431	2,914	4,040,786	661	1,802,328	2,152,913	4,046,230
Bolivia	90	49,772	93	112,071	24	57,225	50	49,548	41	61,378	3	15,152	3,494	52,494
Brazil	18,416	8,345,768	3,674	4,001,145	621	1,451,115	11,440	5,191,763	2,739	2,075,505	118	293,451	170,405	3,049,043
Chile	2,443	1,326,960	1,384	1,412,520	162	343,459	416	245,643	732	947,531	61	192,784	30,318	749,943
Colombia	770	537,682	1,138	1,318,957	334	834,712	409	309,456	816	1,410,604	98	279,555	62,659	881,462
Ecuador	130	69,147	122	145,931	12	48,916	21	13,354	48	46,991	6	11,376	387	22,394
British Guiana	36	23,274	7	8,055			4	3,668	7	6,148			190	16,901
Dutch Guiana	33	16,102	9	10,814					6	3,344				6,699
French Guiana	1	410												2,500
Paraguay	88	51,655	35	37,930			73	56,139	59	64,090			1,341	23,404
Peru	1,206	602,231	394	428,589	74	156,749	145	110,014	558	454,372	11	40,439	9,106	522,327
Uruguay	4,485	2,246,318	1,039	1,203,411	141	314,726	1,082	515,043	404	336,829	72	187,785	26,053	565,062
Venezuela	1,048	519,086	667	740,181	121	285,796	285	212,548	592	540,220	28	85,761	10,994	539,822
Aden	47	28,103	8	7,977	2	4,975	2	1,608	6	7,545	1	3,155	17	10,716
British India	4,832	2,801,401	1,992	1,987,156	135	255,067	4,602	2,602,171	719	691,599	19	20,638	17,220	1,758,671
British Malaya	448	288,607	207	227,790	9	19,447	60	39,302	47	62,978	14	36,138	4,581	504,035
Ceylon	411	291,670	158	163,659	7	16,982	195	153,168	203	255,182	17	25,425	614	123,550
China	1,627	993,282	143	175,850	26	64,592	331	273,173	563	478,015	5	12,948	53,063	420,202
Java and Madura	6,682	3,258,018	1,200	1,288,171	113	236,376	4,837	2,011,243	437	519,800	36	49,854	3,177	819,736
Other Dutch East Indies	678	459,240	134	147,888	22	46,187	195	135,302	121	131,277			2,231	170,772
French Indo China	216	73,461	6	6,482			9	4,427	24	12,202				6,892
Hongkong	272	174,543	69	79,641	2	4,529	48	34,059	49	47,630			32,413	85,995
Iraq	131	53,722	24	26,536	4	7,819	54	37,851	89	68,536			1,404	60,025
Japan	7,195	4,241,388	1,064	1,328,849	170	426,802	924	689,467	911	751,219	189	287,576	6,176,287	3,435,098
Kwantung	223	142,894	21	23,070	15	33,138	24	17,041	55	58,929	3	3,345	3,300	28,985
Palestine	278	168,244	157	174,507	1	1,726	119	84,602	81	71,050	3	4,211	2,191	47,369
Persia	501	256,708	57	61,024	5	8,898	352	190,984	52	110,312	7	21,483	32,998	89,612
Philippine Islands	3,018	1,776,691	538	695,411	118	300,594	1,587	786,892	538	523,984	28	50,866	13,950	670,381
Siam	97	64,659	5	5,354			126	85,161	17	13,781			1,078	62,646
Syria	724	423,415	195	199,322	12	36,716	96	73,839	263	308,762	3	4,797	8,570	106,473
Turkey (in Asia)	942	501,861	130	140,859	25	68,649	589	289,004	142	102,087	2	3,920	1,910	110,131
Australia	30,590	14,502,483	7,162	7,610,955	600	1,361,297	15,469	6,462,806	1,722	1,646,519	114	249,969	797,577	3,172,878
British Oceania	48	25,572	22	27,855	2	4,953	22	10,840	10	9,286			640	11,849
French Oceania	25	12,004	1	1,256			5	2,556	4	5,673			1,394	9,392
New Zealand	8,278	4,624,299	1,875	1,994,018	101	257,400	1,827	780,381	382	506,077	97	122,953	255,237	706,442
Belgian Congo	75	39,471	3	2,891			111	55,209	29	18,687			655	19,345
British East Africa	351	215,984	218	229,270	3	6,282	352	299,191	134	152,960			14,403	245,963
Union of South Africa	15,272	8,320,168	5,566	5,890,230	195	423,575	3,674	1,882,958	559	789,944	38	101,506	58,637	1,362,613
British West Africa	273	164,769	176	191,137	24	48,385	1,020	853,720	342	474,839			120,639	541,774
Other South Africa	527	318,949	280	304,646	5	11,600	178	90,829	23	30,276	3	8,791	992	79,811
Canary Islands	77	46,703	62	72,350	3	8,750	45	25,939	52	56,660	5	10,926	28	32,344
Egypt	2,131	1,135,279	539	572,838	82	188,162	1,050	476,949	185	93,552	2	1,688	14,326	1,165,482
Algeria and Tunisia	163	81,098	9	11,909					43	19,653				4,302
Liberia	28	16,968	6	7,950			29	22,725	11	17,420	1	4,800		23,827
Madagascar	3	1,260							1	1,056			654	6,535
Morocco	689	174,108	111	128,801	2	5,811	530	283,060	114	136,368	3	6,786	439	105,776
Mozambique	239	151,854	101	102,526	3	7,456	94	58,336	64	51,605			1,427	39,031
Other Portuguese Africa	107	58,490	25	25,351			69	42,200	53	51,136			3,310	33,686
Spanish Africa	33	20,946	35	41,285	2	4,531	16	14,939	10	6,639	2	5,101		10,624
Other Countries	269	131,278	27	26,121	3	8,938	225	113,211	113	60,080			3,640	106,093
Alaska	376	335,673	(all types)				80	32,343					113,639	For Parts and
Hawaii	3,989	2,483,235	778	1,008,920	101	266,061	451	230,258	143	294,735	74	211,795	34,068	694,559
Porto Rico	1,143	673,501	557	675,791	156	375,794	311	173,387	267	335,807	83	256,277	25,145	429,106
Totals	*185,572	*$153,143,000	77,669	$87,415,833	11,811	$28,498,863	*105,430	*$51,753,979	31,425	$32,831,851	3,256	$8,337,897	*$62,479,750	$61,448,252

*Not including Alaska

# of Cars, Trucks, Parts and Equipment

Auto Accessories	Service Appliances	Tire Service Equipment	Shock Absorbers		Bumpers	Gasoline and Oil Pumps		Battery Chargers	Spark Plugs		Starting Lighting and Ignition	Asbestos Brake Lining		COUNTRIES
Value	Value	Value	No.	Value	Value	No.	Value	Value	No.	Value	Value	Feet	Value	
$10,919	$3,865	$929	642	$1,759		1	$63		29,480	$8,235	$2,966	27,656	$4,031	Austria
2,102					$72	2	97				100	1,493	209	Azores and Madeira
49,740	19,468	10,174	73	477	9,027	3,262	57,860	$3,420	134,101	47,934	4,381	74,397	15,775	Belgium and Luxemburg
514														Bulgaria
7,737	5,962	124	784	1,288	531	30	795	74	31,270	9,206	3,747	514	534	Czechoslovakia
91,240	6,106	11,326	963	3,222		471	3,947		143,570	30,550	2,939	87,830	14,616	Denmark
1,320	62	131	25	235		3	660					1,219	164	Esthonia
31,934	11,674	5,001	754	3,303	3,165	163	1,083		16,585	5,306	6,394	94,701	17,227	Finland
167,948	46,883	9,352	20	72	100	2,912	38,131	16,993	1,427,009	419,825	97,462	307,745	47,262	France
163,215	66,140	22,373	3,628	24,517	14,540	2,651	57,915	3,725	216,033	68,003	18,464	123,076	20,187	Germany
231														Gibraltar
18,628	2,920	111	27	168	700	59	6,525		13,370	4,061	1,202	48,369	10,092	Greece
4,649	897	345	150	215					20,550	6,289	3,090	25,368	6,982	Hungary
912	67				71						76			Iceland
4,656	40,105	376,601			96	105	11,276	41				24,863	2,423	Irish Free State
136,464	101,839	9,241	134,362	263,417	197	5,251	212,448	6,926	313,480	98,154	44,806	422,256	41,862	Italy
970	127		51	533							92	1,730	310	Latvia
60	30		6	61				254						Lithuania
1,673	83	70				2	551	124	2,000	426				Malta
58,903	23,959	1,458	2,195	11,954	2,158	2,395	89,637	280	87,727	26,246	8,465	47,587	9,484	Netherlands
27,685	17,484	15,115	572	2,697	2,557	587	26,730		33,460	9,891	2,720	38,327	8,382	Norway
5,656	3,082	45	314	712	305	68	12,154		26,700	8,046	2,273	11,916	1,824	Poland and Danzig
10,787	3,516	1,442	144	807	266	8	376	1,085	13,616	4,340	800	29,504	5,362	Portugal
18,070	6,876	4,198	1,265	5,574	44	158	6,289		36,924	12,652	848	10,767	3,889	Roumania
13,409	68,130	6,072	11	150	474	50	350		169,695	62,417	75,412	230	54	Russia (in Europe)
74,449	21,406	9,645	607	3,951	3,557	28	839	7,647	129,225	36,778	15,691	110,011	24,064	Spain
71,973	19,348	14,011	791	5,029	47	1,755	32,652	419	129,840	38,632	18,745	146,330	30,199	Sweden
19,439	17,191	1,992	840	2,143	5,985	17	1,478	4,272	53,945	16,455	2,005	22,251	4,646	Switzerland
														Turkey (in Europe)
168,371	399,530	80,618	11,036	20,434	239	13,899	1,320,536	2,254	180,310	50,665	21,668	37,744	7,634	United Kingdom
906	757	420	240	322		2	30		7,825	2,538	972	4,908	916	Yugoslavia
														United States
3,295,451	366,823	160,518	288,400	688,176	143,509	17,118	317,827	57,547	495,594	161,230	372,062	1,420,842	202,393	Canada
315	3				30				705	343	777			British Honduras
7,370	2,185	458	568	2,434		16	942	172	1,555	779	329	4,791	1,040	Costa Rica
17,344	2,792	375	426	5,179		40	1,528	1,116	3,075	1,158	1,184	9,515	2,271	Guatemala
6,227	724	159	1	10		7	627	72	1,668	852	1,245	821	378	Honduras
4,031		283	58	283	156	12	58	112	1,105	653	736	2,287	880	Nicaragua
19,765	6,460	12,483	21	69	661	64	3,800	1,913	14,093	4,981	5,178	17,020	3,433	Panama
10,405	934	310	61	295	573	4	209	382	1,085	415	450	9,114	2,355	Salvador
181,721	33,881	14,038	177	2,278	8,086	796	45,739	6,086	36,785	13,617	14,191	162,370	36,272	Mexico
4,724	892	592	10	168	52	17	1,038	1,212	148	46	1,150	706	146	Newfoundland and Labrador
2,794	1,366	569	12	49	293	49	2,603	555	80	41	733	2,617	686	Barbados
18,832	9,072	890			1,782	260	16,892	214	2,250	784	544	24,409	6,191	Jamaica
4,696	2,351	105			111	29	1,144	393	472	153	1,229	13,414	3,268	Trinidad and Tobago
3,282	2,001	119	20	155	123	18	1,290	96	1,640	657	654	1,864	591	Other British West Indies
85,468	21,136	10,527	514	4,185	4,684	502	19,156	4,612	57,678	18,549	16,879	211,714	51,539	Cuba
19,880	7,567	397	25	408	338	107	13,959	686	936	309	846	15,715	4,435	Dominican Republic
7,391	6,507	251	46	223	376	27	815	24	1,318	553	891	4,983	1,059	Dutch West Indies
443	109	68				1	42				83	350	165	French West Indies
9,814	3,821	275	128	459	1,138	112	4,130	106	846	266	842	3,014	2,516	Haitian Republic
516	111				26	10	447		18	21				Virgin Islands
473,664	155,244	59,248	9,911	47,014	1,829	10,393	378,678	22,314	189,540	67,460	43,962	473,575	99,416	Argentina
3,638	656					12	60		330	114	442	1,007	313	Bolivia
287,487	221,795	64,424	2,516	14,274	32,948	5,762	378,581	20,976	62,392	23,189	4,463	883,605	154,577	Brazil
68,644	14,034	11,751	4,012	12,808	4,790	1,041	35,759	1,121	18,490	6,658	7,482	56,245	14,541	Chile
122,741	30,818	10,314	498	3,565	5,057	340	22,034	2,982	23,716	9,681	5,893	103,348	26,532	Colombia
7,614	566	1,665	10	76	505	10	441	470	450	166	139	3,728	755	Ecuador
1,572	286				283	3	457	95			487	684	212	British Guiana
242	43				27	15	105		388	182	73	331	46	Dutch Guiana
172						2	10							French Guiana
2,767	1,296					6	30				19	3,798	643	Paraguay
36,986	7,019	12,935	261	1,430	870	69	9,394	502	9,702	3,351	4,437	46,567	4,343	Peru
73,507	26,469	10,710	1,357	6,379	8,901	1,519	65,170	3,795	23,032	8,972	966	78,151	15,372	Uruguay
62,051	9,780	7,489	231	1,194	3,042	252	22,373	1,307	28,592	9,712	4,121	67,905	20,836	Venezuela
2,245		51			12				750	272		714	104	Aden
141,340	18,795	16,848	128	1,350	10,573	280	23,156	913	7,787	3,509	8,676	181,687	36,174	British India
54,377	8,332	1,270	2	17	3,231	295	4,024				3,868	90,909	12,939	British Malaya
9,314	395	549			1,134	6	65	366	4,375	1,331	484	21,077	4,442	Ceylon
65,090	7,837	4,065	4	24	2,951	255	17,276	8,119	21,664	7,208	6,278	65,977	11,481	China
94,156	4,695	1,901	30	274	14,128	229	18,948	1,564	32,782	10,558	3,663	226,779	39,633	Java and Madura
34,366	1,859	974	47	296	1,554	17	164		9,484	2,996	1,373	52,330	13,557	Other Dutch Eas Indies
4,162	936	720			30	12	1,800		4,350	996	88	3,600	1,062	French Indo China
15,894	2,052	468				54	4,258	615	11,845	4,065	1,013	17,439	4,222	Hongkong
2,825	718				3,009						114	8,945	1,940	Iraq
185,394	21,136	41,911	26	103	24,550	171	19,011	35,557	63,638	20,843	150,288	515,939	90,603	Japan
3,426	96				149	2	10	182	1,000	332	443	2,655	417	Kwantung
2,180	89	242			751				1,000	180	170	4,575	1,516	Palestine
3,388	1,096	167			821	3	651		1,000	350		3,779	867	Persia
79,111	19,884	3,835	387	1,557	2,408	267	9,397	1,501	41,256	14,019	25,357	138,491	36,112	Philippine Islands
6,869	1,227	199			421	86	1,540	342	15,651	5,562	1,741	11,993	1,900	Siam
4,355	990	981			908				803	156		14,780	3,006	Syria
23,008	1,141	1,722	312	1,426	1,242	13	185		6,980	2,286	180	9,102	1,861	Turkey (in Asia)
602,937	155,905	56,742	24,420	78,704	1,803	9,234	185,284	36,742	10,190	2,924	16,646	725,710	153,511	Australia
2,407	50	159			119	13	1,558		1,170	535	731	2,802	683	British Oceania
2,264		160			54	1	14		50	23	163	473	208	French Oceania
109,735	94,850	10,556	1,249	5,461	2,582	7,226	214,800	16,629	7,452	1,988	2,586	174,360	36,253	New Zealand
2,174	1,377	23	128	554					4,788	1,816	10			Belgian Congo
17,764	2,283	461	24	195		767	1,337	115	1,330	377	806	25,436	2,686	British East Africa
122,330	58,620	23,042	3,349	14,624	2,708	4,772	89,943	9,073	24,025	6,396	4,085	74,985	11,650	Union of South Africa
8,590	4,803	1,512	286	1,530	561	15	89	48	18,980	7,626	11,677	18,595	4,964	British West Africa
5,199	2,531		80	272		121	660		6,144	987	454	6,463	1,305	Other South Africa
3,808	371	25	22	106	261	1	67		433	153		3,330	1,038	Canary Islands
10,113	1,865	3,631	9	26	3,539	12	1,470	1,039	15,000	3,451	4,283	5,658	1,246	Egypt
282	15,202					840	81,090				279			Algeria and Tunisia
504		33	4	27		2	11	43			25	257	84	Liberia
334									3,025	1,014	99			Madagascar
2,947	111					29	1,408		20,300	6,992	5,582	1,813	389	Morocco
5,817	4,397	140	60	501		623	13,899		982	293	143	3,929	737	Mozambique
12,668	920	107	40	210		57	2,666	33	17,400	6,663	194	8,107	1,472	Other Portuguese Africa
1,464	221	468			110									Spanish Africa
4,486	1,315		990	2,500	210	104	4,788	209	556	230	60			Other Countries
and Accessories Only														Alaska
101,358	46,664	5,504	717	5,391	22,148	332	57,791	2,557	44,726	17,390	12,052	101,301	21,908	Hawaii
42,729	12,129	1,902	621	3,363	5,147	189	16,774	686	18,958	6,872	4,721	64,038	19,524	Porto Rico
$7,827,225	$2,317,111	$1,142,219	501,889	$1,262,746	$371,523	98,217	$4,046,674	$262,683	4,613,998	$1,441,992	$1,096,714	7,915,082	$1,463,085	Totals

cates expanding needs for many products in the metal-working field. Repair facilities, metal-working machinery, handling equipment, tools service station pumps, repair parts, road building machinery, and many other items of metal product manufacture must go into service. As a matter of fact, these things are primarily essential to keep the units on the road, to say nothing of paving the way for further expansion.

The United States is at present the major source of supply to the world for motor vehicles. This country is also, probably, the major source for a good many service units and accessories. The future position does not appear to offer any different outlook, so far as the motor car itself is concerned. The same outlook does not necessarily hold for the equipment and tool manufacturer. Here is a worthwhile export market measurable by the growing use of the motor vehicle. Will these manufacturers take the same steps to reach this market that the motor vehicle manufacturer has been taking for some years past?

In the accompanying tables, the *American Automobile* has listed the countries and export shipments, made in 1928, of cars, trucks, parts and equipment. It should be possible for the tool and machinery and instrument manufacturers to get a good idea of the foreign centers of activity from this tabulation.

Motor vehicles represent but one of the major interests to readers of the *American Machinist*. This metal-working activity is, however, one of the most highly organized, in many ways, of any in the field. On this account it can be watched profitably and used as a worthwhile index by the other major field divisions, as well as a guide to the market for numerous products of the metal-working plant.

Corrosion Resistance With High Strength

A HARD alloy that is resistant to corrosion and acids was described in a paper presented by Burnham E. Field, of the Union Carbide and Carbon Research Laboratories, Inc., at the annual meeting of the American Institute of Mining Engineers, held in New York, February 18-22. It is made up of nickel, molybdenum, and iron, in varying proportions. The most economic combination from the standpoint of the factors of corrosion-resistance, cost and workability seems to be about 20 per cent of molybdenum, 20 of iron, and the remainder chiefly nickel. A small amount of carbon hardens and stiffens the alloy but decreases its resistance to acids. The best results are obtained with not over 0.20 per cent of carbon. When the molybdenum content is over 20 per cent the alloy is difficult to forge.

The physical properties of the alloy are comparable to many high-grade steels. It is readily machinable, and can be hot-rolled into sheet, or cold-rolled. Cold work hardens the alloy, but it can be annealed by heating to about 1,925 deg. F. It can also be welded. The melting point of the alloy is 2,375 deg. F. When forged, it has a tensile strength of about 115,000 lb. per sq.in., a Brinnell hardness of 207, and an elongation of 30 per cent in 2 in. The alloy showed a loss of only 0.00003 in. penetration when exposed to a 37-per cent solution of hydrochloric acid for a month. It should be valuable for any machine parts where resistance to corrosion is necessary, and where high-strength is required at the same time.

Another alloy, which makes strong, tough castings, and is very acid-resistant, contains approximately 10 per cent of silicon, 1.5 to 2 per cent of aluminum, and 3 per cent of copper, with the remainder nickel. The alloy is not forgeable, but is machinable with difficulty with tungsten-carbide tools. Its hardness is 364 Brinnell, but it can be annealed to below 300 by heating for several hours at 1,925 deg. F. and quenching in water. It is claimed to have about five times the breaking strength of the commercial silicon-irons used for corrosion resistance.

Method of Checking Drawings

Discussion

By Morton Schwam

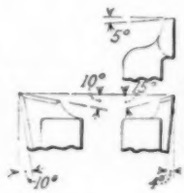
THE article on the above subject which appeared on page 251, Vol. 70 of the *American Machinist*, brings out the method of checking drawings with colored crayons, but it is the writer's opinion, formed through his several years of experience in checking drawings, that Mr. Burd made too radical a statement when he said that the lacking information should be worked up by the checker. This practice is not used by the larger concerns. A drawing made by the draftsman should be complete, the checker should be given all reference drawings, specifications and layouts pertaining to the job, so that he will only have to spend a minimum percentage of time on the drawing and will find it easy to check.

The Checker's Relation to the Draftsman

The checker in a drafting room is considered as overhead, mainly because he is non-productive, and ordinarily is allowed from 15 to 25 per cent of the time spent by the draftsman in making the drawing and therefore can not afford to spend the time to work up the lacking information. It is the checker's job to see that all necessary dimensions for the man in the shop to make the part are given, and to see that the part is so designed as to keep the cost of manufacture as low as possible, and that it will stand the required stresses. The disadvantage of the checker working up the lacking information lies in the fact that the draftsman may become neglectful and not show all that is required on the drawing, thinking that the checker will work up the lacking information for him, and that it will be a simple matter to add it to the tracing when he does. Then again, when the drawing does come back from the checker with additional information, the draftsman will take it for granted that the information supplied by the checker is correct and will add it to the tracing without checking it. The checker is just as liable to make errors as the draftsman and the draftsman will not go to the trouble of checking him.

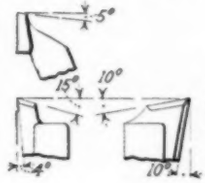
The writer also wishes to bring out the point that when the drawing is sent back to the squad leader for corrections, it should be given to the draftsman who originally made it, to correct, otherwise, a non-interested draftsman will make the corrections as noted by the checker without questioning why the design, or some dimension was changed. It may be that the draftsman who made the drawing had some definite purpose in making the change and unless he also makes the corrections, he does not have an opportunity of discussing the change with the checker. Incorrect drawings frequently get through because of failure to observe this rule.

Grinding Chart for Tools



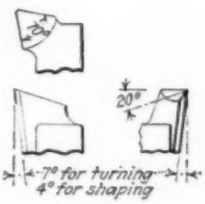
Left Side Tool

For left side facing operations. Narrow enough to reach into recesses. Broad surface allows tool to be used for finishing if it is set parallel to work. A similar shape ground with less rake is used for brass.



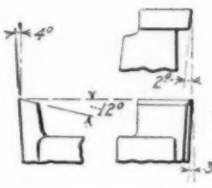
Right Side Tool, Bent

Opposite to above and allows holder to be offset more away from work; handy for facing operations on chucked work. The same shape ground with less rake is used for cutting brass, etc.



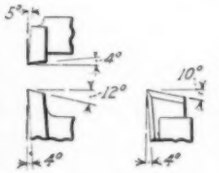
Offset Diamond Tool

For turning operations. Used for either finishing or roughing, specially for reaching into corners. A right hand tool is shown



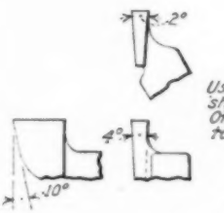
Offset Flat Nose Tool

For finishing operations. Care must be exercised to see that finishing edge is set parallel to work. A left hand tool is shown.



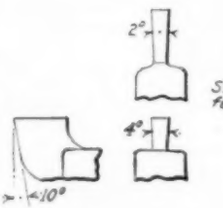
Left Special Boring Mill Tool

An all around boring mill tool. A right hand tool is shown.



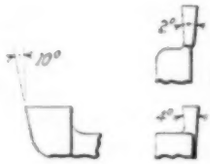
Offset Parting Tool

Used for turning, planing or shaping grooves. Offset tool allows cutting edge to reach into corners.



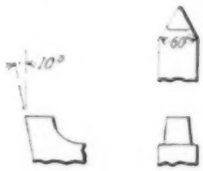
Straight Parting Tool

Straight tool particularly adapted for shaper operations.



Parting Tool

For use where hub or face projects on side of tool. A left hand tool is shown

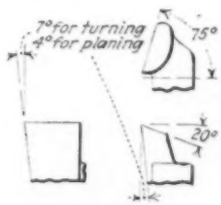


Straight Brass Tool

A general tool for machining brass. Ground with no rake.

Diamond Point Tool

Diamond shape allows tool to be used for roughing or finishing.

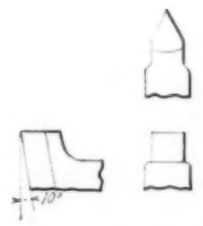


Roughing Tool

An all around roughing tool, as shown, for feeding towards the head of the lathe or from right to left in planing. A right hand tool is shown.

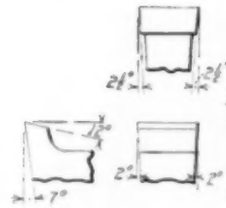
Hog Nose Tool

Applicable for heavy roughing operations in turning or planing. A right hand tool is shown



Thread Tool

Regular threading tool. Flat ground to size of thread. A right thread tool is similar except with 10° offset, allowing holder to clear large shoulders.



Flat Nose Tool

Standard finishing tool. Be sure cutting edge is set parallel to work. May be specially ground for form. A female radius tool is ground for forming inside radii and a male radius tool for forming outside radii.

Courtesy of The O. K. Tool Company, Incorporated

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Proposed Standard Woodruff Keys, Keyslots and Cutters

AS A part of the standardization of shafting, the data in the accompanying tables are submitted in *tentative* form for discussion before adoption as the American standard. Suggestions as to possible changes are to be mailed to C. B. Le Page, assistant secretary, American Society of Mechanical Engineers, 29 West 39th Street, New York City, at as early a date as possible.

A system of numbers for the proposed standards has been so worked out that each number gives the nominal diameter and thickness of the corresponding key. Numerals in the hundreds place indicate diameter increments of $\frac{1}{8}$ in., and those in the tens, $\frac{1}{32}$ inch.

Table I—Dimensions of Woodruff Keys

Number	Nominal Size D × W	Diam. of Key D Max.	Diam. of Key D Min.	Width of Key W Max.	Width of Key W Min.	Height of Key H Max.	Height of Key H Min.
402	$\frac{1}{2}\times\frac{1}{16}$	.500	.490	.0635	.0625	.203	.198
403	$\frac{1}{2}\times\frac{3}{32}$	.500	.490	.0948	.0938	.203	.198
404	$\frac{1}{2}\times\frac{1}{8}$	.500	.490	.1260	.1250	.203	.198
503	$\frac{5}{8}\times\frac{3}{32}$	.625	.615	.0948	.0938	.250	.245
504	$\frac{5}{8}\times\frac{1}{8}$	.625	.615	.1260	.1250	.250	.245
505	$\frac{5}{8}\times\frac{5}{32}$	.625	.615	.1573	.1563	.250	.245
604	$\frac{3}{4}\times\frac{1}{8}$	.750	.740	.1260	.1250	.313	.308
605	$\frac{3}{4}\times\frac{5}{32}$	.750	.740	.1573	.1563	.313	.308
606	$\frac{3}{4}\times\frac{3}{16}$	.750	.740	.1885	.1875	.313	.308
705	$\frac{7}{8}\times\frac{5}{32}$	.875	.865	.1573	.1563	.375	.370
706	$\frac{7}{8}\times\frac{3}{16}$	.875	.865	.1885	.1875	.375	.370
708	$\frac{7}{8}\times\frac{1}{4}$	.875	.865	.2510	.2500	.375	.370
806	1 × $\frac{3}{16}$	1.000	.990	.1885	.1875	.438	.433
808	1 × $\frac{1}{4}$	1.000	.990	.2510	.2500	.438	.433
810	1 × $\frac{5}{16}$	1.000	.990	.3135	.3125	.438	.433
906	$1\frac{1}{8}\times\frac{3}{16}$	1.125	1.115	.1885	.1875	.484	.479
908	$1\frac{1}{8}\times\frac{1}{4}$	1.125	1.115	.2510	.2500	.484	.479
910	$1\frac{1}{8}\times\frac{5}{16}$	1.125	1.115	.3135	.3125	.484	.479
1008	$1\frac{1}{4}\times\frac{1}{4}$	1.250	1.240	.2510	.2500	.547	.542
1010	$1\frac{1}{4}\times\frac{5}{16}$	1.250	1.240	.3135	.3125	.547	.542
1012	$1\frac{1}{4}\times\frac{3}{8}$	1.250	1.240	.3760	.3750	.547	.542
1108	$1\frac{3}{8}\times\frac{1}{4}$	1.375	1.365	.2510	.2500	.594	.589
1110	$1\frac{3}{8}\times\frac{5}{16}$	1.375	1.365	.3135	.3125	.594	.589
1112	$1\frac{3}{8}\times\frac{3}{8}$	1.375	1.365	.3760	.3750	.594	.589
1208	$1\frac{1}{2}\times\frac{1}{4}$	1.500	1.490	.2510	.2500	.641	.636
1210	$1\frac{1}{2}\times\frac{5}{16}$	1.500	1.490	.3135	.3125	.641	.636
1212	$1\frac{1}{2}\times\frac{3}{8}$	1.500	1.490	.3760	.3750	.641	.636

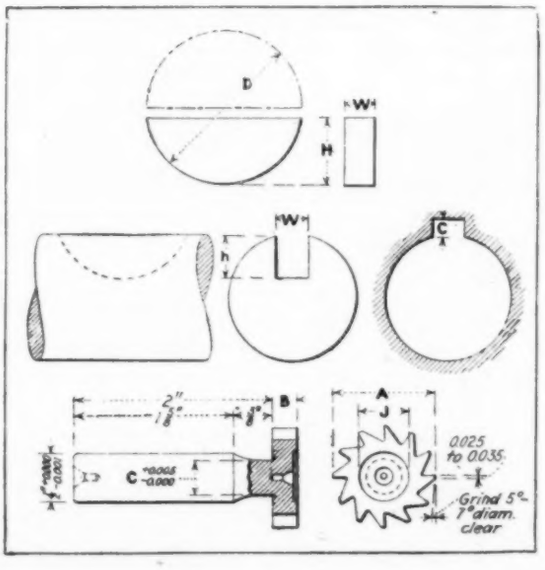
Table II—Dimensions of Keyslots

Number	Size Nominal W×h	Keyslot Width (W) Max.	Keyslot Width (W) Min.	Keyslot Depth (h) Max.	Keyslot Depth (h) Min.	Above Shaft Height (C) Max.	Above Shaft Height (C) Min.
402	$\frac{1}{2}\times\frac{1}{16}$	.0630	.0615	.1718	.1668	.0362	.0262
403	$\frac{1}{2}\times\frac{3}{32}$	.0943	.0928	.1561	.1511	.0519	.0419
404	$\frac{1}{2}\times\frac{1}{8}$	.1255	.1240	.1405	.1355	.0675	.0575
503	$\frac{5}{8}\times\frac{3}{32}$	.0943	.0928	.2031	.1981	.0519	.0419
504	$\frac{5}{8}\times\frac{1}{8}$	.1255	.1240	.1875	.1825	.0675	.0575
505	$\frac{5}{8}\times\frac{5}{32}$	.1568	.1553	.1719	.1669	.0831	.0731
604	$\frac{3}{4}\times\frac{1}{8}$	.1255	.1240	.2505	.2455	.0675	.0575
605	$\frac{3}{4}\times\frac{5}{32}$	.1568	.1553	.2349	.2299	.0831	.0731
606	$\frac{3}{4}\times\frac{3}{16}$	.1880	.1863	.2193	.2143	.0987	.0887
705	$\frac{7}{8}\times\frac{5}{32}$	.1568	.1553	.2969	.2919	.0831	.0731
706	$\frac{7}{8}\times\frac{3}{16}$	.1880	.1863	.2813	.2763	.0987	.0887
708	$\frac{7}{8}\times\frac{1}{4}$	.2505	.2487	.2500	.2450	.1300	.1200
806	1 × $\frac{3}{16}$	.1880	.1863	.3443	.3393	.0987	.0887
808	1 × $\frac{1}{4}$	.2505	.2487	.3130	.3080	.1300	.1200
810	1 × $\frac{5}{16}$	.3130	.3111	.2818	.2768	.1612	.1512
906	$1\frac{1}{8}\times\frac{3}{16}$	.1880	.1863	.3903	.3853	.0987	.0887
908	$1\frac{1}{8}\times\frac{1}{4}$	.2505	.2487	.3590	.3540	.1300	.1200
910	$1\frac{1}{8}\times\frac{5}{16}$	.3130	.3111	.3278	.3228	.1612	.1512
1008	$1\frac{1}{4}\times\frac{1}{4}$	.2505	.2487	.4220	.4170	.1300	.1200
1010	$1\frac{1}{4}\times\frac{5}{16}$	.3130	.3111	.3908	.3858	.1612	.1512
1012	$1\frac{1}{4}\times\frac{3}{8}$	.3755	.3735	.3595	.3545	.1925	.1825
1108	$1\frac{3}{8}\times\frac{1}{4}$	.2505	.2487	.4690	.4640	.1300	.1200
1110	$1\frac{3}{8}\times\frac{5}{16}$	.3130	.3111	.4378	.4328	.1612	.1512
1112	$1\frac{3}{8}\times\frac{3}{8}$	.3755	.3735	.4065	.4015	.1925	.1825
1208	$1\frac{1}{2}\times\frac{1}{4}$	.2505	.2487	.5160	.5110	.1300	.1200
1210	$1\frac{1}{2}\times\frac{5}{16}$	.3130	.3111	.4848	.4798	.1612	.1512
1212	$1\frac{1}{2}\times\frac{3}{8}$	.3755	.3735	.4535	.4485	.1925	.1825

Table III—Woodruff Keyslot Cutters

Number	Size Nominal	Cutter Diam. A Max.	Cutter Diam. A Min.	Cutter Width B Max.	Cutter Width B Min.	Neck Diam. C	Center Drill Body Diam.	Center Drill Drill Diam.	Center Drill Drill Length
402	$\frac{1}{2}\times\frac{1}{16}$	.515	.510	.0620	.0615	.130	$\frac{3}{32}$	$\frac{1}{16}$	$\frac{1}{16}$
403	$\frac{1}{2}\times\frac{3}{32}$	.515	.510	.0933	.0928	.160	$\frac{1}{8}$	$\frac{1}{16}$	$\frac{1}{16}$
404	$\frac{1}{2}\times\frac{1}{8}$	.515	.510	.1245	.1240	.191	$\frac{1}{8}$	$\frac{1}{16}$	$\frac{1}{16}$
503	$\frac{5}{8}\times\frac{3}{32}$	.640	.635	.0933	.0928	.191	$\frac{1}{8}$	$\frac{1}{16}$	$\frac{1}{16}$
504	$\frac{5}{8}\times\frac{1}{8}$	.640	.635	.1245	.1240	.223	$\frac{1}{8}$	$\frac{1}{16}$	$\frac{1}{16}$
505	$\frac{5}{8}\times\frac{5}{32}$	.640	.635	.1558	.1553	.253	$\frac{1}{8}$	$\frac{1}{16}$	$\frac{1}{16}$
604	$\frac{3}{4}\times\frac{1}{8}$	.765	.760	.1245	.1240	.217	$\frac{1}{8}$	$\frac{1}{16}$	$\frac{1}{16}$
605	$\frac{3}{4}\times\frac{5}{32}$	.765	.760	.1558	.1553	.247	$\frac{1}{8}$	$\frac{1}{16}$	$\frac{1}{16}$
606	$\frac{3}{4}\times\frac{3}{16}$	.765	.760	.1868	.1863	.279	$\frac{1}{8}$	$\frac{1}{16}$	$\frac{1}{16}$
705	$\frac{7}{8}\times\frac{5}{32}$	.892	.887	.1558	.1553	.247	$\frac{1}{8}$	$\frac{1}{16}$	$\frac{1}{16}$
706	$\frac{7}{8}\times\frac{3}{16}$	.892	.887	.1868	.1863	.279	$\frac{1}{8}$	$\frac{1}{16}$	$\frac{1}{16}$
708	$\frac{7}{8}\times\frac{1}{4}$	.892	.887	.2492	.2487	.342	$\frac{1}{8}$	$\frac{1}{16}$	$\frac{1}{16}$
806	1 × $\frac{3}{16}$	1.017	1.012	.1868	.1863	.279	$\frac{3}{16}$	$\frac{3}{32}$	$\frac{3}{32}$
808	1 × $\frac{1}{4}$	1.017	1.012	.2492	.2487	.342	$\frac{3}{16}$	$\frac{3}{32}$	$\frac{3}{32}$
810	1 × $\frac{5}{16}$	1.017	1.012	.3116	.3111	.401	$\frac{3}{16}$	$\frac{3}{32}$	$\frac{3}{32}$
906	$1\frac{1}{8}\times\frac{3}{16}$	1.142	1.137	.1868	.1863	.312	$\frac{3}{16}$	$\frac{3}{32}$	$\frac{3}{32}$
908	$1\frac{1}{8}\times\frac{1}{4}$	1.142	1.137	.2492	.2487	.373	$\frac{3}{16}$	$\frac{3}{32}$	$\frac{3}{32}$
910	$1\frac{1}{8}\times\frac{5}{16}$	1.142	1.137	.3116	.3111	.435	$\frac{3}{16}$	$\frac{3}{32}$	$\frac{3}{32}$
1008	$1\frac{1}{4}\times\frac{1}{4}$	1.270	1.265	.2492	.2487	.373	$\frac{3}{16}$	$\frac{3}{32}$	$\frac{3}{32}$
1010	$1\frac{1}{4}\times\frac{5}{16}$	1.270	1.265	.3116	.3111	.435	$\frac{3}{16}$	$\frac{3}{32}$	$\frac{3}{32}$
1012	$1\frac{1}{4}\times\frac{3}{8}$	1.270	1.265	.3740	.3735	.467	$\frac{3}{16}$	$\frac{3}{32}$	$\frac{3}{32}$
1108	$1\frac{3}{8}\times\frac{1}{4}$	1.395	1.390	.2492	.2487	.373	$\frac{3}{16}$	$\frac{3}{32}$	$\frac{3}{32}$
1110	$1\frac{3}{8}\times\frac{5}{16}$	1.395	1.390	.3116	.3111	.467	$\frac{3}{16}$	$\frac{3}{32}$	$\frac{3}{32}$
1112	$1\frac{3}{8}\times\frac{3}{8}$	1.395	1.390	.3740	.3735	.467	$\frac{3}{16}$	$\frac{3}{32}$	$\frac{3}{32}$
1208	$1\frac{1}{2}\times\frac{1}{4}$	1.520	1.515	.2492	.2487	.435	$\frac{3}{16}$	$\frac{3}{32}$	$\frac{3}{32}$
1210	$1\frac{1}{2}\times\frac{5}{16}$	1.520	1.515	.3116	.3111	.467	$\frac{3}{16}$	$\frac{3}{32}$	$\frac{3}{32}$
1212	$1\frac{1}{2}\times\frac{3}{8}$	1.520	1.515	.3740	.3735	.467	$\frac{3}{16}$	$\frac{3}{32}$	$\frac{3}{32}$

The diameters of the cutters are set at the maximum diameter of the keyslot, as that figure will allow the cutter to be reground once or more, depending upon the width. The width of the cutters is about the same as the minimum keyslot width, so that the effect of cutting oversize will give a slot just under the maximum slot dimension. The necks of the cutters $1\times\frac{5}{16}$ in., and larger, are to be made without radius. Cutters are to be concentric within 0.002 in., and sides are to be true within 0.005 inch.



IDEAS · FROM · PRACTICAL · MEN

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit.

A Universal Milling Fixture

By L. I. Machio

The illustrations show a tilting, rotary milling fixture, made for machining parts of die-casting molds, or any small work requiring angular, circular, plain and thread milling. The fixture, a photograph of which is shown in Fig. 1, has been in use for some time in our shop and

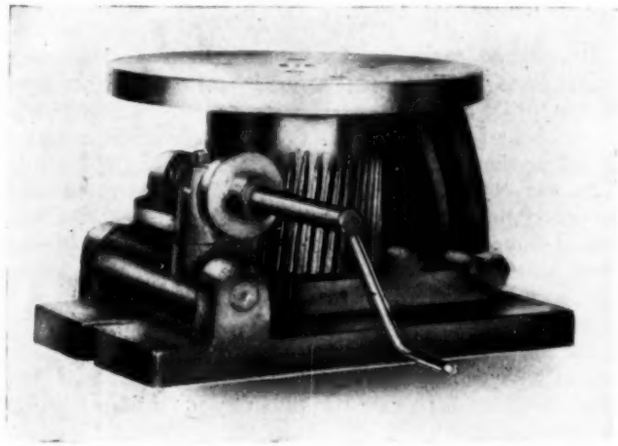


Fig. 1—Universal fixture for the milling machine

is well liked by the toolmakers. The thread-milling feature was incorporated to enable a thread to be milled in a blind hole, close to the bottom, which would hardly be possible were it to be attempted in a lathe.

The cross-section, Fig. 2, gives the constructional details. It is, of course, necessary to make the nut *A* and the screw *B* of the same pitch as that of the thread to be milled. The master nut and lead screw are easily replaced by the shoulder screw *C* when the fixture is not used for thread milling. The ratio of the worm gearing is 40 to 1, and the dial on the wormshaft is graduated in 36 divisions, each division representing $\frac{1}{4}$ deg. of rotation of the table. Provision is made for the angular setting of the table by the use of gage blocks set on a machined pad and under a projecting pin. The pin is accurately spaced to 5 in. from the fulcrum point and the principle of setting to an angle is the same as when using a 5-in. sine-bar. The worm can be disengaged by loosening a screw and swinging out the worm bracket, permitting the table to be rotated by hand. This feature is desirable when rounding corners, or projections, in die work.

A Staybolt Chuck

By Frank C. Hudson

Threading staybolts requires considerable power, and it is no easy matter to hold them against turning under the action of the threading die. Many kinds of staybolt chucks have been tried with more or less success. The chuck illustrated herewith has proved very satisfactory

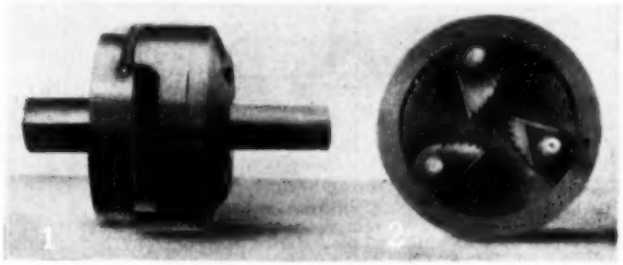


Fig. 1—Chuck with staybolt stock held in its jaws
Fig. 2—Chuck with front plate removed showing location and action of the three jaws

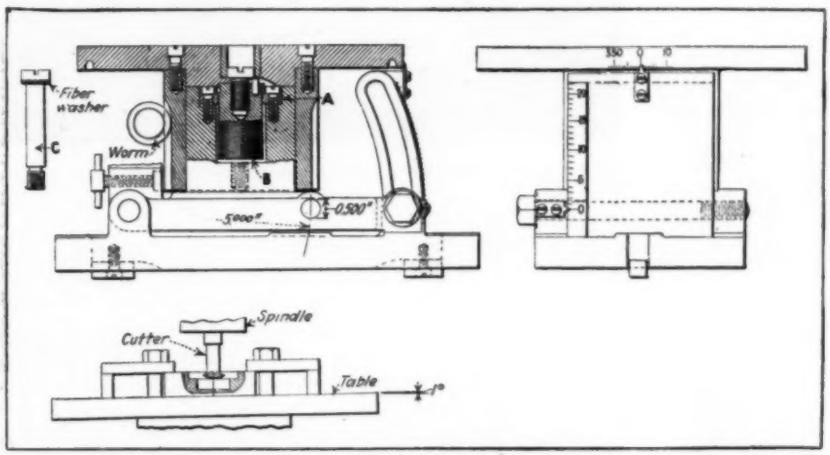


Fig. 2—Constructional details of the fixture

in the shops of the Canadian National Railways at Moncton, N. B. In Fig. 1 is the complete chuck with a piece of staybolt stock gripped in its jaws, while in Fig. 2 the front of the chuck has been removed showing the three jaws mounted on the same studs by which the front, or cover plate, is held in place.

The back end of each jaw carries a projection that fits into a slot in a floating ring that lies between the front and back plates of the chuck, as shown in Fig. 1. The floating ring controls the position of the three jaws, and the springs on the outside tend to force them into their closed position at all times.

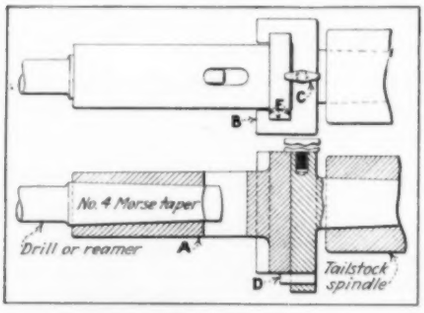
In using the chuck, it is necessary to move the floating ring with a pin wrench against the action of the springs, sufficiently to open the jaws so as to admit the size of staybolt to be cut. On releasing the ring, the springs cause the jaws to grip the staybolt. The twisting tendency of the threading operation tightens the jaws on the work. After the thread has been cut, it requires but little effort to open the jaws and remove the staybolt. This chuck can be used only with a self-opening jaw.

Quick Acting Drill and Reamer Holder for Lathe

By Joseph E. Fenno

The holder as shown in the sketch was designed primarily to decrease the time taken to change engine lathe tailstock tools. The previous method was that of using standard sockets which necessitated driving out the drill, when it was to be replaced by the machine reamer. This method consumed an appreciable amount of time, and it was also necessary to loosen and move the tailstock back in order to remove the tools.

Using the holder shown, the operator simply slides the socket *A* into place in holder *B*, resting on pin *D*. He then turns the quarter turn screw *C* which locks the socket *A* in place. The holder *B* has a taper shank which fits the tailstock spindle. When the drilling of the hole is completed the drill point is fed out until it is within $\frac{1}{2}$ in. of the end of the work. The screw *C* is turned to allow the drill socket to be removed and replaced by the reamer socket, thus making it unnecessary to loosen the tailstock. For use with smaller drills, having smaller shanks, standard sockets are employed in holder *A*. A play of $\frac{1}{64}$ in at *E* provides for a loose fit between the parts.



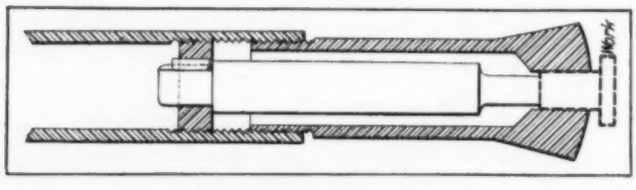
Quick-acting socket for tailstock

Stock Stop for Use in a Spring Collet—*Discussion*

By A. Bliden

The device described by A. D. Leeds, under the title given above, on page 847, Vol. 69, of the *American Machinist*, is not likely to produce satisfactory results if accuracy of length is desired in the finished pieces. As the work is tightened by the collet being drawn back against the conical opening in the lathe spindle, it will be found that any slight variation in the diameter of the pieces, or of the force used for tightening, will result in marked differences in the length of the work, perhaps to the extent of 0.005 in., depending upon conditions. A stop of this sort is reliable only when the closing of the collet is accomplished by means of an advancing sleeve within the spindle, as in the Brown & Sharpe screw machines.

A better method of arranging the stop is to attach it by any suitable means to the draw-in tube, which does not move endwise when the collet is closed onto the work, so that the stop, when adjusted, retains its relation to the lathe spindle and not to the collet. I have used this arrangement as shown in the illustration, with good results, though it has the defect of reducing the gripping effect of the collet, which will be understood when the action is analyzed.



Stop for a spring collet

Setting a Magnetic Chuck to Accurate Angles

By Matthew Harris

In setting swiveling magnetic chucks for grinding angles, it is usually the practice to set them either by a protractor or by a graduated collar attached to the chuck. By neither of these methods, however, can great accuracy of setting be obtained.

In the chuck illustrated in Fig. 1, arms fitted with hardened and ground pins have been attached to the base and to one of the trunnions. Gage blocks placed between these pins afford a method of setting the chuck to angles by chordal distance. Since the chord of any angle is twice the sine of half that angle, it is necessary only to know the center distance of the pins from the trunnion, and to have a table of sines, to calculate the size of gage block to place betweens the pins to set the chuck to the desired angle.

The angle of the arms in relation to the face of the chuck is such that when the pins are brought into contact, the face of the chuck is at a slight angle, the lowest part being in front. To set the chuck level, a gage block of the proper size must be inserted between the pins. In setting the chuck to any angle, the angular distance between the pins when the chuck is level, must be taken into consideration in calculating the heights of the gage blocks to be used.

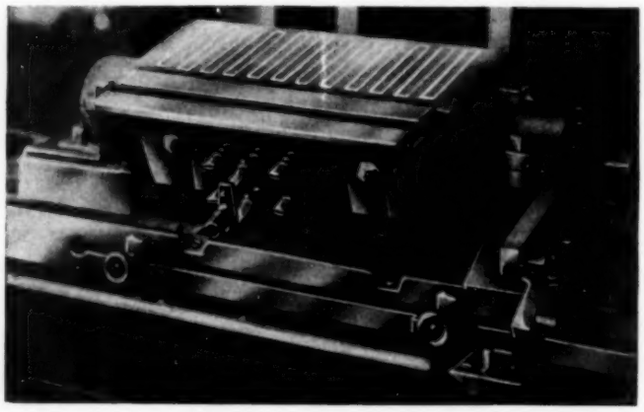


Fig. 1—Swiveling chuck arranged for setting to angles by chordal distances

For angles of 45 deg. or greater, it would be somewhat difficult to hold the necessary combination of gage blocks between the pins while setting the chuck. In

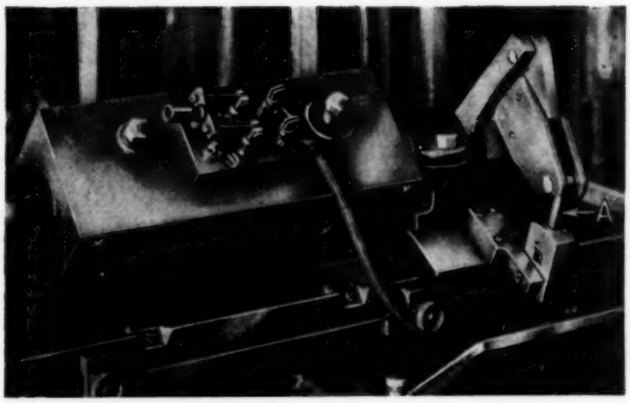


Fig. 2—Harness for setting chuck to an angle of 45 deg. or greater

such cases, the harness to be seen on the chuck in Fig. 2 is applied. In the yoke surrounding the lower pin, is a micrometer, the spindle of which is extended to form connection *A*. The end of the barrel contacts with the pin surrounded by the yoke. When the micrometer is set to read zero, the chuck is at an angle of 45 deg. Turning the micrometer barrel in either direction will change the angle of the chuck to more or less than 45 deg., depending upon the direction in which it is turned. When set to the desired angle, the chuck is clamped in position by tightening the caps over the trunnions.

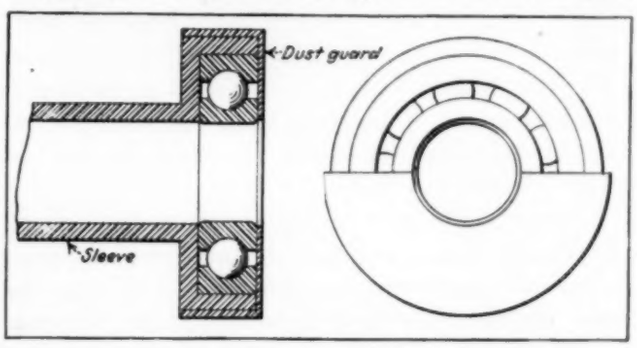
Ball-Bearing Support for Boring Bars and Cutter Arbors

By J. Z. Bromley

The illustration shows a ball bearing for the outer support for the bar on a horizontal boring mill. It has relieved us of the uncertainties of the ordinary bushing, or sleeve, when used in conjunction with unhardened boring bars and cutter-arbor sleeves. We replaced the ordinary bushing with a sleeve such as is shown in section. Half of the dust guard has been cut away to make the relation of the ball bearing to the sleeve a little clearer. The end of the sleeve is made large enough to accomodate a carefully-selected ball bearing, the inner diameter of which is a very neat sliding fit on the largest standard bar used on the machine. The guard, as shown, fits neatly over the end of the sleeve and extends inwardly over the face of the bearing, protecting it from dust and chips. The ball bearing is a press fit in the sleeve, and the sleeve, in turn, is pressed into the bearing support.

When we wish to use boring bars or cutter arbors with sleeves of smaller diameter than the inside diameter of the ball bearing, we use a cast-iron bushing that is a light drive fit in the bearing and a very neat sliding fit on the bars or the arbor sleeves. We find that a bushing having a length of about 2½ in. has a surprising length of life with hardly any appreciable wear, since the only wear is that due to the horizontal travel of the bar.

In our present practice, we use the one ball bearing only, and have the sleeves extend almost through the bearing support. If in a larger machine, a longer support should be found desirable, it could be easily obtained by shortening the body of the sleeve on the small diameter and pressing in a similar sleeve from the back of the bearing support. The lengths of the sleeves on the small diameters are half the thickness of the bearing supports.



Support for boring bars and cutter arbors

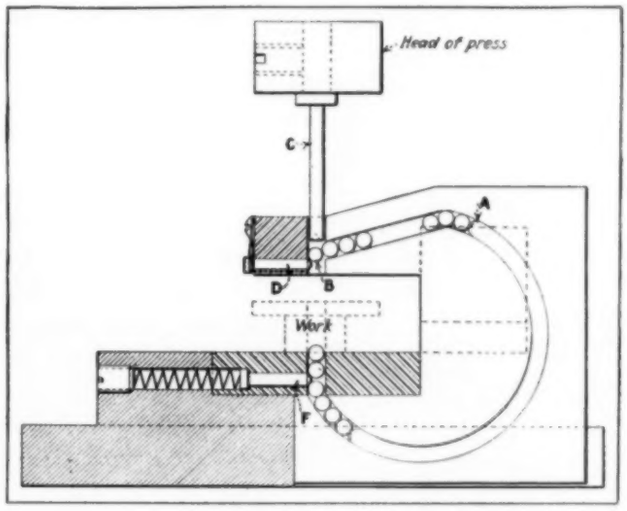
Burnishing Holes in Aluminum

Discussion

By Wm. S. Mahan

A burnishing tool for aluminum-base metal was described by Mr. Carl E. Schinman, on page 549, Vol. 69, of the *American Machinist*. The tool described is good, but I believe we are using a method far superior to the one he described.

This fixture, which can be applied to either a foot or power press, consists of a holder which carries a race *A*, filled with balls. One of these is always in position *B* ready for the punch *C*, to push through. This ball is prevented from dropping by the plunger *D* held by the flat spring. When the plunger *C* descends, the ball precedes it through the hole to be sized. The punch is slightly smaller in diameter than the ball and has a concave end.



A continuous hole-burnishing fixture

After the ball has been pressed through the work, the plunger *F* holds it in such a position that it acts as a locator for the next part to be burnished. The plunger also prevents the balls from flowing backward. A slot in the race at the bottom makes it self-cleaning.

For burnishing a small hole with one pass, the ball should be approximately 0.002 in. larger in diameter than the finished size of the hole. This method gives a compact surface well burnished, and superior in finish and size, to a reaming operation, besides being faster.

American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

Engineering and Litigation

IF PRESIDENT HOOVER is able to carry through the painfully necessary revision of the judicial system of the United States advocated in his inaugural address he will have accomplished something that has baffled his predecessors, and every other citizen who has had the vision to realize what is going on. It is not in the least surprising to find the man who instituted the campaign on waste in industry aiming his heaviest guns at a national waste that makes the waste in industry look picayune.

But he is likely to encounter an entirely different attitude in his latest endeavor to promote national welfare. In the campaign against industrial waste it was not so very difficult to enlist the support of industrial leaders whose pocketbooks were directly benefited by the campaign. Litigation, on the contrary, is more likely than not to be a losing game for both of the principals in a civil suit. In a criminal case no one can win but the lawyers. In spite of the best efforts of the judiciary and the bar associations to shorten the judicial processes, these are so bound round with tradition and precedent that they have resisted all attempts with complete success. After all, the great majority of legislators are lawyers, and their enactments are interpreted by lawyers some of whom earn their livelihood by keeping their cases before the courts as long as possible. No wonder that the courts are clogged and that disrespect for laws is on the increase!

Much of the blame has been laid at the door of the Prohibition Amendment and its enforcing legislation. Some of it is justified, of course, but the investigating commission will unquestionably find that the inherently wasteful processes of the courts are at least as much responsible. It is to be hoped that one of the findings of this commission will lead to a sweeping clearance of the statute books of unenforceable laws.

In spite of its many handicaps of legal and other wastes the United States has enjoyed amazing prosperity of recent years. What a brilliant future lies ahead if these handicaps can but be removed!

A Job for the Designer

NOT satisfied with the close approach to mechanical perfection achieved by the designers and producers of the modern automobile some of our prominent citizens are demanding design changes that will relieve the driver of all effort except the twisting of the steering wheel. R. R. Updegraff in the *Magazine of Business* and Roger Babson in the *Forum* are both complaining that the annoyance of shifting gears in the congested city traffic is too much to be borne.

Apparently it is up to the designer to do something. The automobile gearset, about as efficient and fool-proof a mechanical device as has yet been made, must be replaced by something better. What that is to be is no concern of the critics. They are quite willing to leave the details up to the designers and engineers.

We must all admit that sliding gears leave something to be desired in the operation of a motor vehicle, yet what is there that will do the job they are doing, with equal efficiency? Electric transmissions have been tried. So have hydraulic ones. Neither has served to displace the sliding gear. Perhaps this failure is due to prejudice or to the danger of attempting to sell a fickle public a mechanical device with which it is unfamiliar. At any rate, the gear is still supreme.

Will it remain so, and how long? And what is to supersede it? The designer must find the answer.

Better Lubrication

THERE is a noticeable trend toward greater care in the lubrication of machinery. Both builders and users are realizing that a large proportion of the delays in production can be traced to lack of, or to improper, lubrication. Too frequently the failure of a comparatively insignificant bearing ties up the whole machine, which emphasizes the old adage that "no detail is too small to have careful attention."

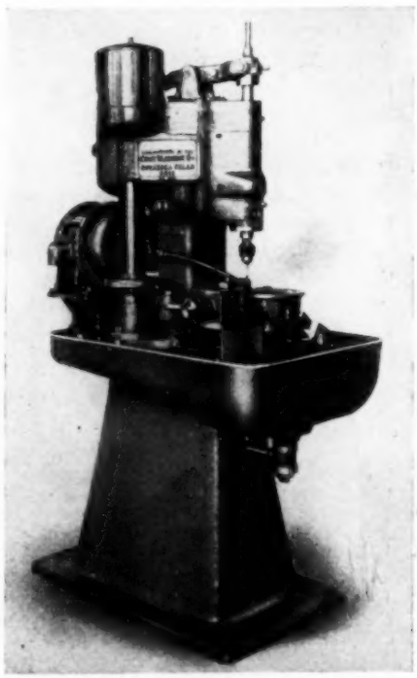
The changes noticed involve, for the most part, positive means of getting lubricant to the bearing. The open oil hole is giving way to a pressure-gun connection, or, if the bearing is not easily accessible, a tube leads from the bearing to some point that is easily reached.

Proper lubrication is being recognized as an important factor in machine design and construction. It affords ample opportunity for ingenuity and improvement and promises to be of great value in maintaining production.

Kent ⅜-Inch Dial-Feed Drilling Machine

A MACHINE has been built by the Kent Machine Company, 268 North Water St., Cuyahoga Falls, Ohio, for rapidly drilling, burring, or countersinking parts which can be fed by a dial plate and clamped during the machining operation. Aside from placing the part in the dial plate, the action of the machine is continuous and entirely automatic. The dial-feeding interval is short, and idle time is reduced to a minimum. A special dial-feed mechanism for various work within the capacity of the machine can be arranged, making it universal in its adaptation, yet special for each different piece to be drilled. Rigidity is obtained by means of the heavy base and column.

When drilling into the end of the head of such pieces as cap screws, or similar parts, the dial carries the part



Kent ⅜-Inch Dial-Feed Drilling Machine

to a position under the spindle where it is centralized by a pair of jaws which grip the part by the body. One of these jaws is fixed but can be adjusted for various sizes; the other jaw is movable and is cam-actuated. The dial does not restrict the centralizing of the part, but merely serves to convey it under the spindle. For drilling at right angles to the center line of a cylindrical piece, the dial plate can be provided with radial slots, and the jaws clamp the ends of the piece before the drilling action takes place. A bracket is provided to carry a guide bushing placed immediately above the part being drilled. After the part has been drilled the dial plate carries it around to the discharge chute.

The cam shaft speed controlling the timing operations can be so regulated that full capacity of the machine is obtained. Practically any predetermined speed and feed of drill can be secured in design.

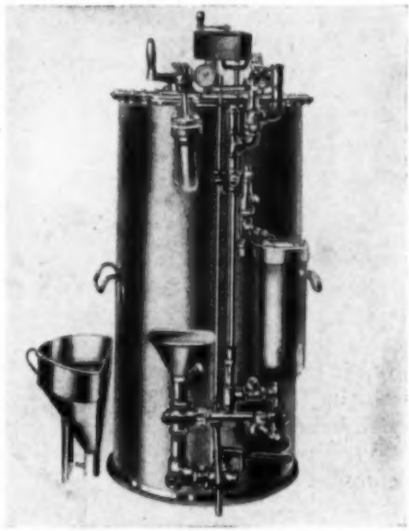
The capacity of the machine is up to ⅜-in. diameter drill in steel, ¾-in. deep. It can be furnished with a cone belt drive, or a constant-speed motor drive, and is supplied mounted on a pedestal, or arranged for bench use. The weight of the floor type is 1,350 lb. Floor space, 24x44 in. A 2-hp. 1,200-r.p.m. motor is required for driving.

"Prest-O-Weld" Type MP-101 Medium-Pressure Acetylene Generator

Safety, simplicity and minimum pressure fluctuation during operation are the outstanding characteristics of the type MP-101 medium-pressure acetylene generator, according to the Oxweld Acetylene Company, 30 East 42nd St., New York, N. Y. This generator is intended for use with either medium-pressure or low-pressure welding and cutting blowpipes, and is designed to meet the demand for a stationary-type acetylene generator that can be carried easily from place to place on a truck or wagon. It is rated at 60 cu.ft. per hour, which is ample for most welding and cutting operations, and it uses 30 lb. of ¼x1½-in. carbide at a charge. A pleasing color combination has been worked out; the body is gray, all the acetylene pipes are red and all water pipes are black.

Heavy gage material has been used in the construction of MP-101 generator, and where strength is required of the fittings steel castings have been used. Bronze welding has been used for joining the generator shell and fitting. All parts are either galvanized or sherardized. The carbide valve is rotated by means of a spring clock motor, which is governed by an "Oxweld" diaphragm-type motor feed control. Pressure adjustment is made by means of a thumbscrew on the motor feed control. Should by any chance both the motor brake and relief valves fail to function, the motor locks at about 18 lb. per sq.in., thereby stopping the carbide feed. Fluctuation of pressure during the normal operation is less than 1 lb. per sq.in. and the pressure limit is 15 lb. per sq.in. for normal operation.

The motor for the feed mechanism is inclosed in a dust-tight housing. It



"Prest-O-Weld" Type MP-101 Medium-Pressure Acetylene Generator

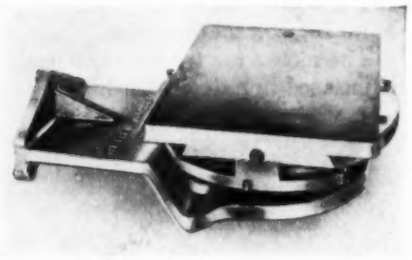
is wound easily with a permanently attached ratchet lever. When the generator is being moved, the hopper can be sealed by raising the feed valve. This valve is also raised automatically every time the carbide filling door is opened. The hopper and generator body are so designed that no water will enter the hopper in case the generator is knocked over. The hydraulic back-pressure valve and filter are contained in a seamless drawn shell with a flange cover and an outlet casting, all bronze-welded to the shell.

The overall dimensions of the generator are: Height, 60 in., and

width, 34 in. The weight of the generator empty is 305 lb., while with a full charge the total weight is 623 pounds.

Frew Elliptic Chuck for Vertical Turret Lathes

An elliptic chuck designed to turn out elliptical pieces weighing up to 800 lb. on the Bullard vertical turret lathe has been announced by the Frew Machine Company, 124 West Venango St., Philadelphia, Pa. The chuck was necessitated by the inability of ordinary production engine lathes to carry such a piece supported on the end of a lathe spindle. The feet of



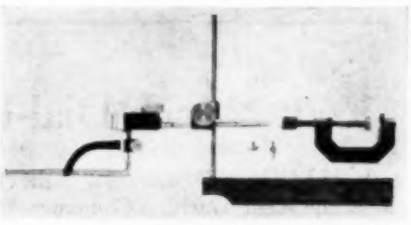
Frew Elliptic Chuck for Vertical Turret Lathes. Ellipses 18x16 in. can be turned

the chuck are clamped against the column of the vertical lathe and the revolving member is attached to the table. The faceplate is 16½x21 in., and is used to turn out ellipses of 18 x16 in. An attachment is incorporated in the chuck for varying the relation between the two axes of the ellipse.

Brown & Sharpe No. 740 Dial Indicator Set

All types of testing, setting up, and inspection of machine work can be done with a No. 740 dial indicator set, according to the Brown & Sharpe Manufacturing Company, Providence, R. I. It is claimed that the compactness and convenience of the set make it useful in many places ordinarily inaccessible to the ordinary indicator. It can be adjusted to almost any position, and can be used in narrow places and in holes. The size of the dial, which is 1 1/16 in. in diam., is small enough to permit the easy insertion of the tool between the throws of a crankshaft for inspecting crankshaft bearings and pins. The tool can also be used on a universal surface gage, and is easily adjusted for use on the toolpost of a lathe, on a planer tool, and on a milling machine arbor.

Long life and accuracy of the set is assured by the fact that the helical cam, which is the heart of the mechanism, has four sections and may be turned to bring a new section into play, if wear or accident should impair the accuracy of the indicator. The dial is adjustable, and by turning the knurled rim the zero may be brought into any postion. A range of 1/10 in. either side of zero is provided, and the dial is graduated in



Brown & Sharpe No. 740 Dial Indicator Set

thousandths. The tool consists of a dial indicator with hole attachment, bar with upright rod, slide with indicator rod, and three chromium-plated contact points.

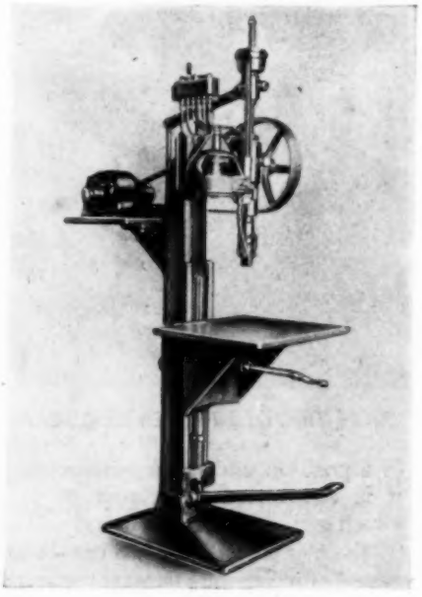
Reynolds No. 2 Heavy-Duty Screw-Driving Machine

ANY three consecutive sizes of wood or machine screws, lying in the range from Nos. 6 to 14 inclusive, can be driven by means of the Reynolds No. 2 heavy-duty screw driving machine equipped with an automatic magazine feed. This unit is announced by the Reynolds Machine Company, Massillon, Ohio. It will drive screws to the center of an 18-in. circle in work not over 18 in. high, and on work requiring greater depth of throat, a gap column may be substituted. This gap column permits screws to be driven to the center of a 48-in. circle in work not over 6 in. high. Below the gap the machine has same depth of throat as the standard machine, or 9 inches.

With regard to the length of screws that can be driven, all below No. 10 must not be longer than 1½ in., whereas from No. 10 to 14 inclusive, screws up to 1¾ in. long can be driven. The range of screws driven can be increased by the use of an interchangeable set of parts, but no change is necessary for different lengths of screws. When it is necessary to bore the hole before driving the screw, a boring attachment can be furnished extra. This attachment may be either of the single-spindle or multiple-spindle type.

As will be noted in the illustration, a gravity oiling system is installed to supply lubricants to the main bearings. The spindle runs at 700 to 850 r.p.m. and upwards, depending on the character of the work. It is supported at the upper end by a ball-bearing spindle coupling, and is actuated by means of a treadle equipped with a spring that causes the spindle to return to the upper position after a screw has been driven. The flange ring, dial ring, guard ring, chuck bushing, and body and chuck jaws are all of hardened steel and where necessary they are ground. The chuck jaws are replaceable, and they are equipped with an equalizing mecanism.

The machine illustrated is driven by means of a motor belted to the spindle, but a belt-driven type may be obtained. The large table is 21x24 in., and the base is 21x27 in. in area.



Reynolds No. 2 Heavy-Duty Screw Driving Machine equipped with an automatic magazine feed

Sterling Air-Cooled Buffers and Grinders

Several buffers and grinders have been placed on the market by the Sterling Electric Motors, Inc., Telegraph Road at Atlantic Boulevard, Los Angeles, Calif. The pedestal models comprise a two-wheel grinder, such as illustrated, a combined grinder and buffer, and a buffer and polisher with an extended shaft. Three bench models are also available, these being a grinder with wheels

Sterling Air-Cooled Pedestal Grinder

only, a grinder equipped with guards and toolrests, and a grinding, polishing, or buffing motor only.

All pedestal models are available in sizes up to 1½ hp. in single-phase types, and up to 2 hp. for three- or two-phase circuits. The first two types of bench grinders are available in ¼-hp. sizes only, while the polishing motor is available in sizes from ½ to 5 hp. All models are available in a variety of frames. Air cooling of the motor and the use of ball bearings on the spindle are other features.

Jones Star Flexible Coupling

Only three parts are used in the star flexible coupling developed by the W. A. Jones Foundry & Machine Company, 4401 West Roosevelt Road, Chicago, Ill. The coupling is composed of two flanged semi-steel castings with three projecting lugs

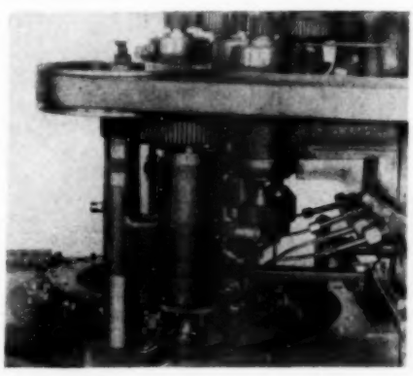
Parts of the Jones Star Flexible Coupling

on each half which engage a central star-shaped rubber disk. The slope of the lugs is such that the load on the disk is in compression over a large surface. The tendency, therefore, is to compress the disk towards the center. The exposed surfaces of the castings are completely machined. This type of coupling is particularly suited for work where weight and space must both be conserved, according to the manufacturer.

Three sizes of this star flexible coupling are manufactured. They are Nos. ⅝, 1, and 1⅜, having corresponding bores in inches. The diameters are 2½, 3½, and 4½ in., and the overall widths are 2 5/16, 3 3/16, and 4 1/16 in., respectively. These couplings are intended for a maximum speed of 2,000 r.p.m. The weights are 2, 3½, and 8 lb., respectively.

Slotting Attachment for Anderson Dial Tapper

A slotting or milling attachment has been developed for use with the dial tapper made by the Anderson Die Machine Company, Bridgeport, Conn. The milling spindle shown in the foreground of the accompanying illustration is pivoted outside of the feeding dial proper, and is operated



Application of the Slotting Attachment to the Anderson Dial Tapping Machine

by means of a cam placed on the main vertical shaft of the machine so as to synchronize with the elements of the machine. The operations on the piece being machined consist of, first, slotting, then tapping three holes at right angles to the slot, after which the fixture is indexed, and the hole into which the slot is cut is tapped with a 10-32 tap. This attachment is suitable for application to machines using dial plates such as shown in the machine illustrated on page 176, Vol. 69, of the *American Machinist*.

Hall Bench Forge

By causing the flame to impinge directly on the floor at the center, the temperature of the Hall bench forge can be brought up to its maximum of 2,250 deg. F. within 5 min. after starting, according to the manufacturer, the Hall Machine & Tool Company, 116 Chestnut St., Providence, R. I. As will be noted in the illus-

Hall Bench Forge

tration, the burner enters the top of the furnace at a 45 deg. angle. It is equipped with a pilot light arrangement, which makes a convenient means for easy and rapid starting. The temperature range of the forge is from 500 to 2,250 deg. F., and the temperature can be maintained at any point.

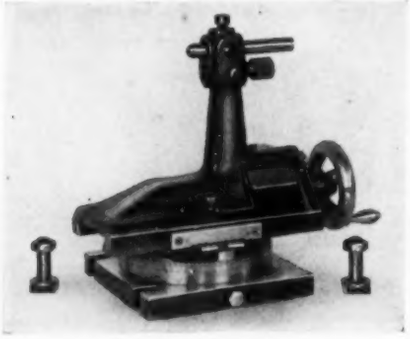
The heating chamber measures 3x3x7 in. and with no obstructions, provides ample space for passing long pieces through it, so that any desired spot can be heated without the necessity of heating the entire length. The unit is constructed of cast iron, and is lined throughout with heavy refractory. For the best results it should be operated at an air pressure of at

least 1 lb. per sq.in. Both the gas and air inlets are for standard ¾-in. pipe. The forge is furnished complete with all valves ready for piping to the gas and air lines. It is supported on a sturdy stand, which brings the entrance 7 in. from the top of the bench, and it takes up 14x14 in. of space.

Brown & Sharpe Radius and Angle Wheel-Truing Attachment

A radius and angle wheel-truing attachment for use on the No. 2 surface grinding machine has been announced by the Brown & Sharpe Manufacturing Company, Providence, R. I. The attachment is designed to provide an accurate and efficient means of shaping abrasive wheels used on the No. 2 machine. It is particularly useful when grinding such work as lamination dies, flat forming tools, and miscellaneous pieces requiring wheels having radial or angular faces.

The attachment consists of a base



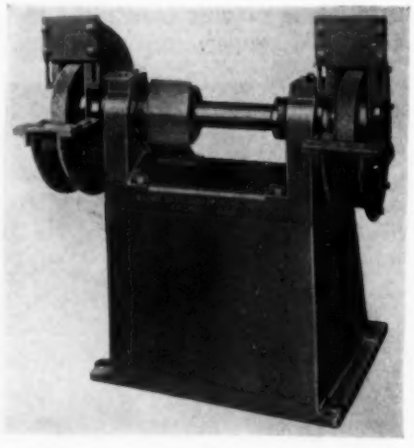
Brown & Sharpe Radius and Angle Wheel-Truing Attachment for the No. 2 Surface Grinding Machine

of cast iron graduated to 90 deg. on either side of zero, and carrying a swivel platen as shown in the accompanying illustration. A slide, which can be adjusted longitudinally by a handwheel to 64ths either side of zero, is mounted on this platen. A gib and adjusting screws afford means of compensation for wear. An upright, integral with the slide, holds the diamond tool and the diamond tool setting gage. By the use of this attachment, outlines having concave or convex radii, varying from 0 to 1 in., and face angles up to 90 deg. either side of zero can be formed. Also, numerous combinations of radial and angular shapes otherwise difficult to obtain can be developed easily.

Convex and concave shapes are obtained by setting the slide by means of the scale to the desired radius, and clamping it in position. The diamond point is set by the diamond tool setting gage, and is clamped in position. The diamond is then swiveled to an arc sufficient to develop the radius upon the wheel. Angular faces are formed by clamping the swivel at the required angle and operating the slide by means of a handwheel. The diamond tool is held in the upright post at right angles to the slide. By means of clamping bolts and nuts the attachment is securely clamped to the machine table. The base is fitted with tongues.

Kling Type B High-Speed Grinders

A line of small high-speed grinders, designated as Type B, has been placed on the market by the Kling Bros. Engineering Works, 1300 North Kostner Ave., Chicago, Ill. These grinders are available in bench and floorstand types, the latter being illustrated. They are made with cast frames of semi-steel, using cored construction. Wheel shafts are 0.40 carbon steel, finished all over, and fitted with "Super-Strom" double-row radial ball bearings. Chucks are of cast steel, finished and balanced. Wheelguards are of fabricated steel, conforming to the American Engineering Standards safety code. Bearings are of the fully-inclosed labyrinth type. The drive pulley is rubber covered to minimize belt slippage.

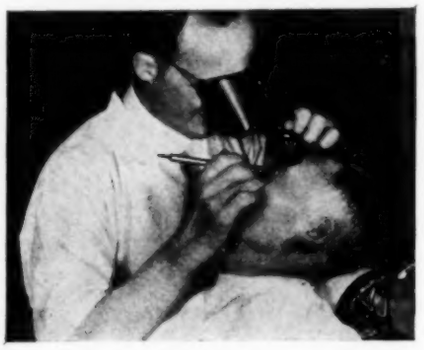


Kling Type B High-Speed Grinder of the floorstand type

These units are made for use with 18x2x7-in. rubber-bonded or Bakelite grinding wheels for high-speed rough grinding and snagging, and operate at a peripheral speed of 9,000 surface ft. per min. Because of the high speed of the wheels and the sturdy construction, the manufacturer makes claims for the unit of fast grinding and high efficiency.

"Magneprobe" Electro-Magnetic Surgical Probe

In most cases, particles of iron and steel can be removed quickly from an injured eye in the industrial first aid station by the use of the "Magne-



A particle of steel is being removed from the eye of the patient by means of the "Magneprobe"

probe," an electro-magnetic steel probe. The instrument was developed by the First Aid Department of the Hawthorne Works of the Western Electric Company, Inc., and is being manufactured and marketed under license by V. Mueller & Company, surgical instrument makers, Ogden Ave., Van Buren and Honore Sts., Chicago, Ill. This small instrument is a powerful permanent magnet in the form of a surgical probe, and is just about the size of an ordinary lead pencil. One end is sharpened to a point for removing particles from the eye, and the other is flattened for use in cases where the fragment has penetrated into the flesh. It is made of one of the "Honda" high-cobalt steels, which has high magnetic properties. With ordinary care the probe will retain its magnetic strength indefinitely. As it is made of rust-resisting steel, it may be sterilized repeatedly.

According to the manufacturer, statistics from several large industrial plants show that well over 80

per cent of the cases in which iron and steel particles had entered the eyes of workmen, the particles had lodged in the outer surfaces, thus bringing these cases within the scope of usefulness of the probe.

Shaler Spring Winder

Both pull and compression springs from the smallest size up to $1\frac{7}{8}$ in. in diam. can be made on the hand spring winder illustrated, made by the Shaler Company, Waupun, Wis. These springs can be made in any length, in 2 min. it is claimed, from wire up to $\frac{5}{32}$ in. in diameter.

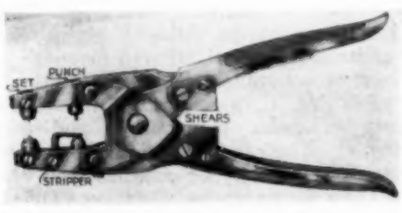
The process of spring making consists of inserting the wire into

Shaler Spring Winder

the rolls and carrying the front end into a slot at the end of the arbor, after which the handle is turned and the spring wound to the correct length. A positive space adjustment is provided that may be regulated so that the coils can be spaced accurately up to $\frac{5}{8}$ in. apart. Springs of various diameters are produced by winding them on different size arbors. Material furnished with the winder consists of five arbors and three rolls of wire.

Pittsburg Steel Tape Repair Outfit

Repairing of steel tapes can be done on the job by the use of the repair outfit illustrated. This tool has been placed on the market by the Pittsburg Instrument & Machine Company, 1026 Reedsdale St., Pittsburgh, Pa. It should be particularly useful to persons in shops and warehouses since it enables them to mend a broken tape within a few minutes. All the necessary appliances are attached to the tongues. The shears will cut the various steel tapes in use and the punch will cut through two thicknesses where the splice laps over. The rivet set at the end of the jaws will complete the job. According to the manufacturer, the rivet holes can be cut near the edge of the splice without danger of splitting the tape.



Pittsburg Steel Tape Repair Outfit

REVIEW · OF · RECENT · PATENTS

Relating to the Machinery and Metal Products Industries

Metal-Working Machinery

A multiple drillhead was patented, 1,700,975, by Joseph F. Buhr, of Detroit, Mich. The chief feature is that the drill sleeve and bearings are readily removed by taking out a drive pin.

The National Automatic Tool Co. was assigned a patent 1,700,980, on an intermittent drilling and tapping machine. It comprises a number of spindles in a box head, and a rotating work table, which presents the work successively to the tools.

A keyway-cutting machine was patented by Joseph Hajos, of St. Louis, Mo., 1,700,795. The machine is small, and has a frame adapted for mounting on the shaft. The cutter is supported in a frame having longitudinal guides, and is traversed by means of a screw and handwheel.

A dieing or blank-cutting machine was patented, 1,701,082, and assigned to L. Candee & Co. The machine has a conveyor for supporting and feeding the sheet stock to the blanking dies.

Parts and Mechanisms

A stuffing box of unusual design for a rotating shaft was patented, 1,700,731, and assigned to the Baker Ice Machine Co., Inc. The box has a series of metallic packing rings with rotating race rings containing balls. The whole is held in place by a plate and spring bolts.

A patent, 1,700,735, on a punch holder for metal-trimming machines was assigned to the E. J. Manville Machine Co. The holder has a swinging stripper containing a bushing and a means of preventing the body of the holder from being withdrawn.

A roll-feed mechanism was patented, 1,700,736, and assigned to the E. J. Manville Machine Co. It consists of two shafts in a suitable housing with feed rolls and driving gears. The feed rolls may be detached, and the shafts withdrawn without disturbing the gears.

Materials

A coating material for protecting metal molds in die-casting was patented, 1,701,159, and assigned to Earl Holley, Detroit, Mich. It consists of a refractory insulating material mixed with a small percentage of aluminum chloride as a binder.

A brake band material was patented, 1,700,759, by Heinrich Borchers, Nienburg am Weser, Germany. The method of manufacture consists in impregnating asbestos threads with an adhesive, causing comminuted, grit-like, roughened material to adhere to the impregnated threads, drying the product, and then weaving into a fabric.

Trade Publications

DIE SETS AND ACCESSORIES. The E. A. Baumbach Manufacturing Co., 1,812 So. Kilbourn Ave., Chicago, Ill., has published Catalog No. 5 entitled "The Baumbach Die Set Guide," which shows fifteen different styles of die sets. Each style is fully illustrated and described and the sizes available are given in tables. The catalog contains 119, 11x9-in. pages.

NICKEL STEEL PRODUCTS GUIDE. The International Nickel Co., 67 Wall St., New York, N. Y., has published a "Buyers' Guide for Nickel Alloy-Steel Products," under date of January 1, 1929. As the name would imply, the bulletin consists of the names and addresses of manufacturers of nickel-alloy steel products, according to products. The bulletin contains twelve 11x8½-in. pages.

SPEED REDUCTION AND TRANSMISSION MACHINERY. Winfield H. Smith, Inc., Springville, Erie County, N. Y., has published catalog No. 23, superseding No. 22, showing various types of speed-reducing mechanisms and light power-transmission equipment. All material listed in this catalog is standard, and is carried in stock. The catalog contains 30, 6x4-in. pages.

STEEL PLATES. The Carnegie Steel Co., Pittsburgh, Pa., has published the first edition for 1929 of "Rolled Steel Plates for Column Bases, Bearing

Plates, Bridge Shoes, Machinery Bases, Etc." The data is given in the form of tables.

TESTING MACHINES. The Tinius Olsen Testing Machine Co., 500 North 12th St., Philadelphia, Pa., has issued Bulletin E, showing various types of ductility testing machines and attachments, extensometers, and dynamometers. The bulletin contains twelve, 11x8½-in. pages.

WELDING EQUIPMENT. The Torchweld Equipment Co., 224 North Carpenter St., Chicago, Ill., has published Catalog No. 28, showing various types of welding equipment such as blowpipes, regulators, accessories, acetylene generators, and steel trucks. The catalog contains 36, 9x4-in. pages.

BUSINESS STATISTICS. The Department of Commerce, Bureau of the Census, has published a "Record Book of Business Statistics," which is a supplement to the Survey of Current Business, and is known as Part 2, Metals and Machinery. This booklet contains current statistics on the machinery industry since the end of the World War, with the exception of data on machine tools. The booklet is available from the U. S. Government Printing Office for 10 cents.

CARBON BRUSHES AND BRUSH SHUNTS. The Department of Commerce, Bureau of Standards, has published Simplified Practice Recommendation R56-28 on carbon brushes and brush shunts. The dimensions and tolerances are given. The recommendation may be obtained from the U. S. Government Printing Office for 10 cents.

COATED ABRASIVE PRODUCTS. The U. S. Department of Commerce, Bureau of Standards, has issued Simplified Practice Recommendation R89-28 entitled "Coated Abrasive Products," which lists 1,976 stock sizes and types, instead of 8,000 varieties as formerly carried on hand. More than 600 individual concerns have accepted the recommendation. The catalog, which contains 20 9x6-in. pages, may be obtained from the U. S. Government Printing Office, Washington, for ten cents.

COMMERCIAL FORMS. The Department of Commerce, Bureau of Standards, has issued Simplified Practice Recommendation R37-28 on the Commercial Forms (Invoice, Inquiry, and Purchase Order). The recommendation illustrates models for these forms and gives the various savings which it is expected they will effect. The bulletin contains 12, 9x6-in. pages.

CORROSION OF SHIP PLATES. The U. S. Department of Commerce, Bureau of Standards, has issued Research Paper No. 42, entitled, "Laboratory Corrosion Tests of Mild Steel with Special Reference to Ship Plate." It is stated that the laboratory test results contained do not confirm in any way whatsoever the claims made for unusual superior corrosion resistance of the ship plate used on the *Leviathan* in comparison with other ship plate. The pamphlet may be obtained from the U. S. Government Printing Office, Washington, for 5 cents.

DEMAG NEWS. A copy of the *Demag News*, a quarterly published by the Demag, Duisburg, Germany, has been received. This house organ, printed in English, illustrates and describes modern cold-rolling plants, a large-size pig-bed dressing and pig-molding machine, dockyard cranes, various types of speed-reducing mechanisms, electric furnaces, and various types of ore handling equipment. The issue at hand contains 28 12x8½-in. pages.

HACK-SAW BLADES. The Department of Commerce, Bureau of Standards, has published Simplified Practice Recommendation R90-28 on hack-saw blades. The recommendation lists the sizes of hand and power hack-saw blades, there being four of the former and twelve of the latter. The bulletin, which contains 12, 9x6-in. pages, may be obtained from the U. S. Government Printing Office, Washington, for 5 cents.

MACHINE TOOL DEVELOPMENT. The Technical Section of The Association of Engineering and Shipbuilding Draftsmen, 96 St. George's Square, London, S. W. 1, has published a paper by E. W. Tipple, entitled "Present-Day Developments in Machine Tools." This paper was delivered at the Olymphia Show Sept. 15, 1928, in connection with the Fourth Machine Tool and Engineering Exhibition, and discusses from the British point of view such features of machine tool design as machine drives, broaching machines, gearing, structural design, cutting steels, and hydraulic feeds. The paper, with the accompanying discussion occupies 30, 8½x5½-in. pages and may be obtained for 2 shillings.

MATERIAL HANDLING. The Cutler-Hammer Manufacturing Co., 12th and St. Paul Ave., Milwaukee, Wis., has published a booklet entitled, "Modern Metal Handling Methods," which is a photographic presentation of the application of magnets to various kinds of work in foundries and metal-working shops.

ROPE DRIVES. William Kenyon & Sons, Ltd., Chapel Field Works, Dukinfield, near Manchester, England, has published a book entitled "Rope and Rope Driving," which is a treatise on rope drives, containing material on modern systems of rope driving, advantages, limits, applications, pulleys, maintenance, and finally, the rope to be used. The booklet contains 87 figures and 146, 8½x5½-in. pages.

ROPE DRIVING. Thomas Hart, Ltd., Blackburn, England, has sent a booklet entitled "Rope Driving or the Transmission of Power by Ropes," which contains 43 illustrations and 84, 8½x7½ in. pages on ropes and rope drives. The design, selection, angular driving, and splicing instructions for rope drives are treated.

SAFETY WORK. The Metropolitan Life Insurance Co., New York, N. Y., through the Policyholders' Service Bureau, has issued Industrial Safety Booklet No. 3 entitled "Directing The Plant Safety Work." This deals with the need for competent direction of safety activities in both large and small organizations and outlines the qualifications, duties and functions of the safety director.

SHEARING MACHINES. The Association of Engineering and Shipbuilding Draughtsmen, 96 St. George's Square, London, S.W.1, has published a booklet entitled "Shearing Machines for Steelworks," by F. H. Roberts. This booklet goes thoroughly into the design of various types of shearing machines, all of the calculations necessary being included. Various types are illustrated. The booklet contains 23 figures and 35, 9x6-in. pages. It sells for two shillings.

TAPS—CUT AND GROUND THREADS. The Society of Automotive Engineers, Inc., 29 West 39th St., New York, N. Y., has issued S.A.E. Production Engineering Standards on Taps —Cut and Ground Threads, giving the general dimensions and the pitch and major diameters for machine-screw taps, hand-plug taps, tapper taps, straight-pipe taps, and spark-plug taps.

THE INTERNATIONAL TEMPERATURE SCALE. The U. S. Department of Commerce, Bureau of Standards, has issued Research Paper No. 22 entitled "The International Temperature Scale," presenting the agreement entered into by the Bureau of Standards, National Physical Laboratory of Great Britain, and the Reichsanstalt, Germany, and affording a satisfactory basis on which uniformity in certification of temperature measurements for industrial purposes may be maintained. The bulletin can be obtained from the U. S. Government Printing Office, Washington, for five cents.

THERMAL EXPANSION OF MAGNESIUM. The U. S. Department of Commerce, Bureau of Standards, has published Research Paper No. 29 entitled "Thermal Expansion of Magnesium And Some of Its Alloys," giving the results of an investigation of magnesium over various ranges between —183 and +500 deg. C. and most of the alloys between room temperature and 300 deg. C. The catalog contains 24 9x6-in. pages, and it may be obtained from the U. S. Government Printing Office, Washington, for ten cents.

News of the Week

Porter Heads Engineering Foundation

H. Hobart Porter has been elected chairman of the Engineering Foundation, joint research bureau of the Founder Engineering Societies, to succeed L. B. Stillwell, who has served since 1925. Mr. Porter has long been active in business, engineering, and science, as well as in the educational and civic life of New York. He is president of the American Water Works and Electric Co., and of the Brooklyn City Railroad Co. He is chairman of the board of the West Penn Electric Co., and vice-president of the Queensboro Gas and Electric Company.

Mr. Porter is a member of the division of engineering and of the executive committee of the National Research Council; of the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, and the American Society of Mechanical Engineers. He became a member of the Engineering Foundation Board in May, 1918, serving until February, 1924. He was re-elected to the board in 1927. He is a trustee of Columbia University, from which he was graduated in 1886 with the degree of M.E. Mr. Porter was born in New York City in 1865, and was engaged in mining engineering in Mexico and Arizona until 1894, when he became a member of the engineering firm of Sanderson and Porter, New York, with which he has since been identified.

Causes of Unemployment Being Studied

In promoting the stabilization of employment, prime reliance is to be placed on the ability of private industry to work out its own solution of the matter, it is stated in the recent report of the Education and Labor Committee of the Senate on the causes and remedies of unemployment. Disapproval is expressed of the suggestion that the government undertake the establishment of unemployment insurance, although it is recommended for adoption by private employers. The chief function of the government in the situation should be in the remodeling of the federal employment service in such a manner as to enable it to co-ordinate the work of the state bureaus, it is proposed.

The causes of unemployment are divided into three classes: Cyclical, seasonal, and technological. In recommending that the best means of combating cyclical unemployment is through the control of credit, the report directs attention to the results thus far obtained by the Federal Reserve System. As to the other two classes, seasonal and technological unemployment, it is brought out that the most serious problem exists in the technological field where machinery constantly is supplanting human labor and where old industries steadily are giving way to new ones. No concern should be given to undue consideration of seasonal unemployment, it is pointed out, since most large employers already realize the advantages of spreading production throughout the year as much as possible. It is recommended, however, that because of the complicated nature of the problem of mitigating unemployment caused by mechanical inventions and the changing nature of industry, more attention be given this phase of the situation before legislation is proposed dealing with it.

In concluding, the report calls attention to the beneficial results that would be brought about through the adoption of the Jones "Prosperity Reserve Bill," in which it is proposed that the federal government and other public agencies so order their public works that they will act as a buffer in times of unemployment.

Industrial Advertising of Atlanta Pays

The Industrial Bureau of the Atlanta Chamber of Commerce has issued a report concerning the results of the national advertising campaign Atlanta has been conducting since the early part of 1926 to attract new industries, the report paying a worthy tribute to the advertising value of trade and class papers as these have comprised about the only medium used.

Records of the Atlanta Chamber of Commerce show that from 1912 to 1925, inclusive a total of 465 new outside concerns located in the city, an average of about 33 per year. From 1926 to 1928, inclusive, the three years of the present campaign, 484 new outside concerns have located in Atlanta, an average of about 161 per year, 1928 proving the best year with a total of 175 firms.

The aggregate payroll of the 484 concerns is nearly $23,000,000 per year, and though some of this is doubtless due to the normal growth of the city, it is conservatively estimated that $8,000,000 of this amount at least may be directly attributed to this advertising. Thus, for an investment of less than $1,000,000 in three years Atlanta has added approximately $8,000,000 per year to its business income, as there is little doubt but that most of this money will be spent with Atlanta firms.

So successful has the campaign proven that it is thought likely it will be continued next year.

Financial Reports Show Progress

The National Acme Co. for the year ended Dec. 31, 1928, reports net profit of $1,209,114 after charges, interest, federal taxes, etc., equal to $2.41 a share (par $10) on 500,000 shares of stock. In 1927 company reported profit of $202,076 after charges but before federal taxes. Surplus Dec. 31, 1928, was $1,895,251.

Report of the Niles-Bement-Pond Co. and subsidiaries for year ended Dec. 31, 1928, shows net profit of $607,733 after expenses, depreciation, etc. This compares with $244,155 in 1927. The above 1928 net profit does not include any income from Pratt & Whitney Aircraft investment, except dividends reecived on preferred stock.

The Curtiss Aeroplane and Motor Co., Inc., and subsidiary companies for the year ended Dec. 31, 1928, report net profit of $7,528,782 after interest and Federal income tax provisions. Current assets are carried in the balance sheet at $7,497,209, while current liabilities are shown as $940,106, leaving a net working capital of $6,557,103.

The Yale & Towne Manufacturing Co. reports for 1928 net profit of $2,152,631 after depreciation and reserve for Federal taxes. This compares with $1,939,751 in 1927. Current assets are carried at $14,922,017 and current liabilities at $1,700,511, leaving a net working capital of $13,221,506.

Report of the Union Carbide & Carbon Corporation and subsidiaries, for the year ended Dec. 31, 1928, shows net income of $30,577,382, after federal taxes, depreciation, depletion, interest, and subsidiary preferred dividends. This compares with $25,340,660, in 1927.

The E. W. Bliss Co. declared the regular quarterly dividends of 25 cents on the common, $1 on the first preferred, 87½ cents on the Class A second preferred and 15 cents on the Class B second preferred, all payable April 1 to stock of record March 19.

The Westinghouse Air Brake Co. and subsidiaries for the year ended Dec. 31, 1928, report net income of $6,490,557 after charges and federal taxes, compared with $8,520,009 in 1927.

Report of the New York Air Brake Co. for the year ended Dec. 31, 1928, shows net income of $894,493 after depreciation, interest, federal taxes, etc. This compares with $1,096,666 in 1927.

The report of American Brown Boveri Electric Corporation and subsidiaries for the year ended December 31, 1928, shows net profit of $612,216 after interest, discounts, etc., and deduc-

tion of amount applicable to minority interest. This compares with profit of $51,793 before federal taxes in 1927.

The Nichols & Shepard Co., Chicago, manufacturer of grain threshing machines and combines, reports for the year ended December 31, 1928, net income of $735,844 after depreciation, interest and federal taxes. This compares with $532,219 in 1927.

The report of the Spicer Manufacturing Co. and its subsidiaries for 1928 shows net profit of $2,609,533 after depreciation and federal taxes. This compares with net income for 1927 of $1,116,352.

The Electric Auto-Lite Co., Toledo, reports for the year ended December 31, 1928, consolidated net income of $7,778,818 after depreciation, interest and federal taxes, compared with $2,363,475 in 1927. Earnings of $1,078,550 after charges and preferred dividends but before federal taxes, are reported for January. The local plant is operating 24 hours a day on three shifts.

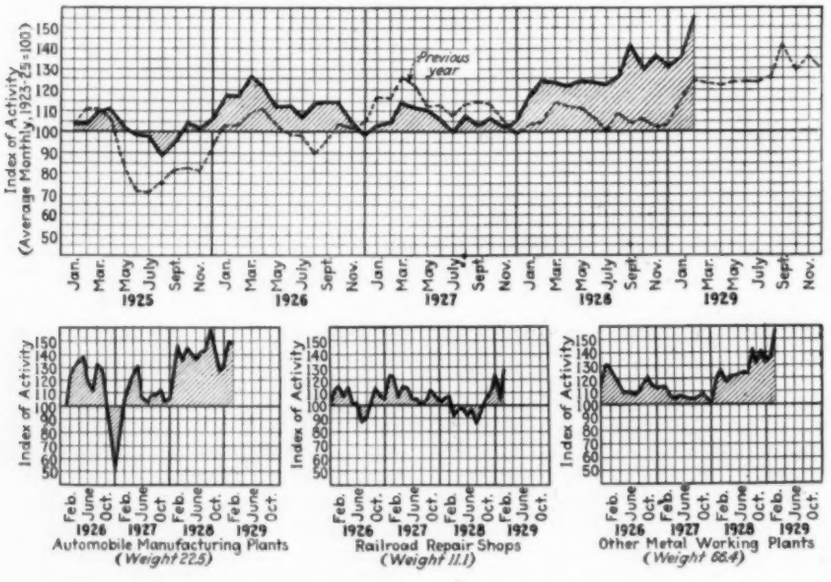
The report of the Motor Products Corporation for 1928 shows a net profit of $2,643,749 after interest, depreciation, federal taxes and other charges. In 1927 the profit before federal taxes was $575,879.

The report of Worthington Pump & Machinery Corporation and subsidiaries for year ended December 31, 1928, shows net income of $974,076 after depreciation, compared with $600,343 in 1927.

The Perfect Circle Co., Chicago, manufacturer of piston rings, reports for the year ended December 31, 1928, net profit of $772,195 after charges, compared with $537,962 in 1927.

Record Metal-Working Activity During February

INCOMPLETE reports on the consumption of electrical energy by the metal-working plants of the country indicate that a new record for rate of operations was hung up in these plants during the month of February. The February rate of operations, after corrections are made for the number of working days, was 15 per cent above that reported for January, 15.4 per cent above February last year, and 9.4 per cent over the previous record rate of operations established during September.



The automobile industry is the only branch of the metal-working field which did not report a material increase in the rate of operations during February as compared with January. Preliminary reports indicate that for the first time since September, 1927, the automobile plants, which group includes the manufacture of repair and replacement parts, were operating at a rate under that of the same month in the year previous. February operations in these plants were at a rate of 1.1 per cent under January, and 0.6 per cent under February last year. In spite of these slight drops, however, the automobile manufacturing plants are in general operating very close to capacity.

Railroad repair shops are apparently operating at the highest rate in the history of the industry. February rate of operations were about 8 per cent over February last year.

Other metal-working plants were also operating on a record high plane. February rate of operations in these plants was 16.4 per cent over January and 23.8 per cent over February last year. The previous high rate of operations in these plants was recorded in September last year.

January Foundry Output Gains 18.7 Per Cent

Increase in foundry production during January of 18.7 per cent is reported by the Gray Iron Institute for 77 members. Normally, the tonnage produced is 18,695 short tons, but 22,202 tons were turned out in an effort to meet the growing demand. The trend toward higher production levels is clearly indicated by a gain of 28.5 per cent in the new business received during the month by 43 member foundries. Unfilled orders at the close of the month as reported by 41 concerns, totaled 12,287 tons, or 125.6 per cent of normal. As to the business outlook reported by the Institute, 71 foundries report as follows: Good, 41; fair, 27; poor, 2, and bad, 1.

Leipzig Fair Draws Big Attendance

Over 200,000 buyers from 43 countries are in attendance at the Leipzig Trade Fair which opened on March 3. The present fair has four times as many exhibits and about ten times the attendance of any pre-war fair, giving evidence of the industrial comeback of Germany and Europe in general in recent years.

It is estimated that more than 2,300 buyers came from the United States to attend the fair. American products are more in evidence among the exhibits than ever before. Among them are exhibits sent by the Port Authority of New York and the Boards of Trade of Philadelphia and Baltimore, stressing the importance of these ports of entry for European trade. America is also prominent among the exhibitors of labor-saving machinery and production machine tools.

A feature of the Spring fair is the display of building materials, machinery, and iron and steel products, forming a group of about 2,000 exhibits. This year the fair is the largest in the 700 years of its history.

Use Roller Bearings on Electric Locomotives

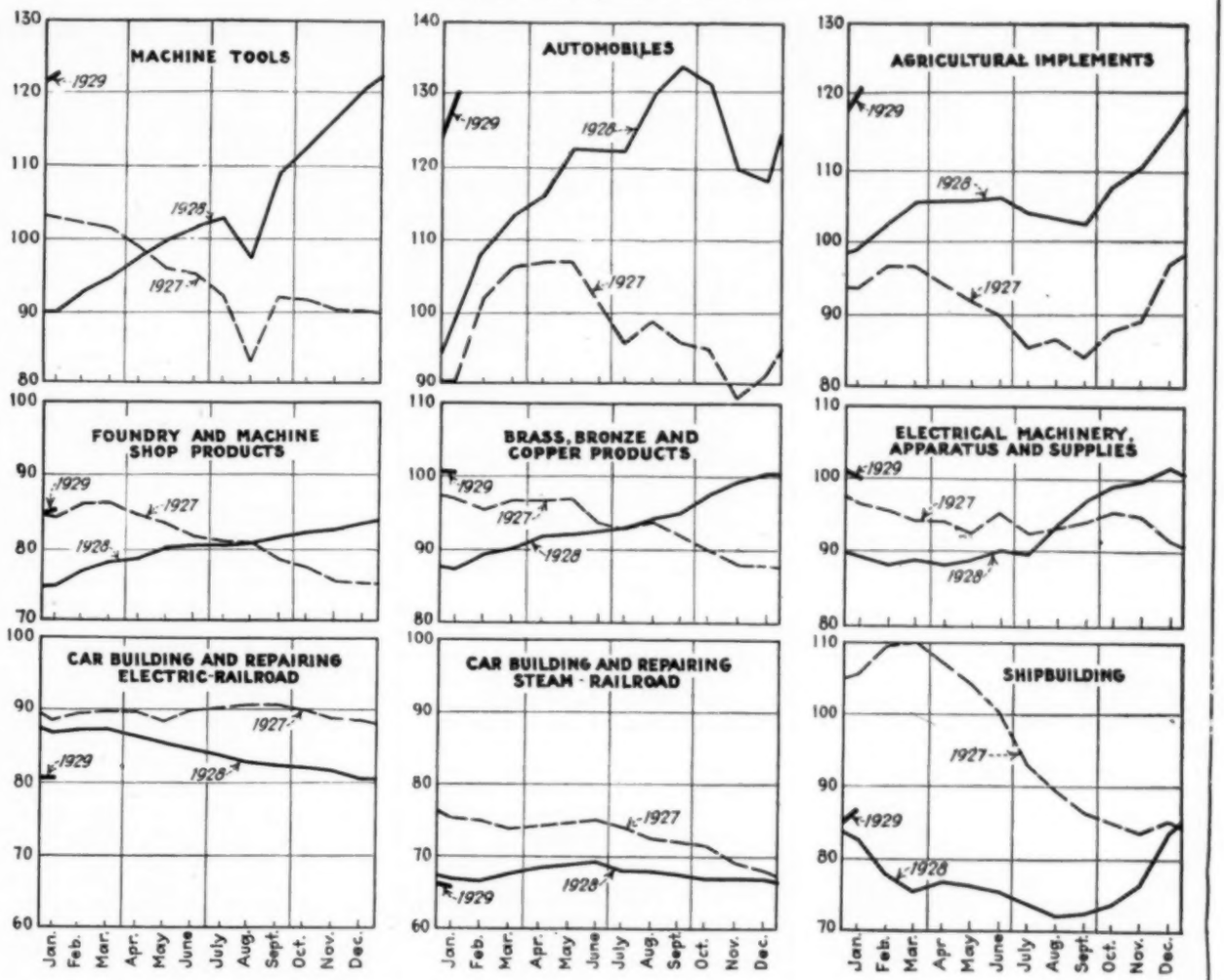
Heavy-duty roller and ball bearings are being used on the powerful electric locomotives recently put into service by the Great Northern when it opened its new 8-mile tunnel through the Cascade Mountains. Each locomotive has eight motors with a total rating of 4,330 hp., 1-hour rating, and has a tractive effort of 112,500 lb. for hauling 2,900-ton freight trains up the 2 per cent grades on the tunnel approaches with two locomotives in tandem.

Each motor on this Baldwin-Westinghouse, motor-generator locomotive is equipped with a roller bearing at one end and a ball bearing at the other held for thrust. The armature weight is 3,730 lb., and the shaft is 6 in. in diam. The outside diameter of the

Trend of Employment in the Chief Metal-Working Industries

Data Supplied by the Bureau of Labor Statistics

Monthly Average for 1923—100



Increases in employment were made during January for all the principal metal-working industries except steam-railroad, car building and repair shops, where the trend has been downward for the past seven months. The greatest single rise over December, 1928, figures was made in the number of employed in the automotive shops, an increase of 10 per cent, with agricultural implement manufacturing plants next in order, then shipbuilding yards.

roller bearing is 12 in. In passenger service, the motor armature may rotate at 1,450 r.p.m., abnormally high for this size of bearing. Norma-Hoffman heavy-duty bearings are used.

Cincinnati Branch N.M.T.A. Elects

Charles H. Fox, president of the Ahrens-Fox Fire Engine Co., has been elected president of the Cincinnati Branch of the National Metal Trades Association. George A. Seyler, works manager of the Lunkenheimer Co., is vice-president; George Schiele, secretary, and Harry A. Feldbush, works manager of the Worthington Pump & Machinery Co., is treasurer. The new executive committee is composed of: Fred. V. Geier, vice-president of the Cincinnati Milling Machine Co.; R. E. LeBlond, associated with the R. K. LeBlond Machine Tool Co.; and August Marx, vice-president of the G. A. Gray Planer Co. E. A. Muller, president of the King Machine Tool Co., presided at the banquet on March 7, at which the elections took place.

Foundry Equipment Makers Elect Officers

At the annual meeting of the Foundry Equipment Manufacturers Association held at the Cleveland Hotel, Cleveland, March 5, Henry W. Standard, president of the Northern Engineering Works, Detroit, was unanimously elected president for the ensuing year; Arthur F. Jensen, president of the Hanna Engineering Works, Chicago, was elected vice-president, and H. Cole Estep, vice-president of the Penton Publishing Co., was re-elected secretary-treasurer. Two new directors also were named: M. C. Sammons, secretary, Wadsworth Core Machine & Equipment Co., Akron, Ohio, for the year 1929; and J. P. Jones, manager of sales, machinery manufacturers section, General Electric Co., Schenectady, for the years 1929-1931.

L. P. Robinson, sales manager, Werner G. Smith Co., Cleveland, gave an address, entitled "What is Becoming of the Foundryman's Dollar?" C. J. Stark, president, Penton Publishing Co., spoke on the business outlook.

The reports of the members on business conditions were exceedingly encouraging. The average of sales for the first two months this year was 90 per cent in excess of the corresponding period last year.

BUSINESS BAROMETER . . . . *Present record industrial activity is interpreted by some of the forecasters as an approach to a peak, with a slump to follow*

By THEODORE H. PRICE

Editor, Commerce and Finance, New York

From this page the reader will get a quick picture of current business and industry. The boxed material below is a summary of the letters from regional correspondents of the American Machinist, published in full on the opposite page.

ALTHOUGH the thumbscrews of credit are gradually being tightened under the direction of the Federal Reserve authorities, the stock market is giving ground but slowly, and the action of the Anaconda Copper Mining Company in following the example of the United States Steel Corporation by selling more stock in order to retire part of its outstanding bonds is evidence that the cult of the common stock is still in its heyday.

As long as there are buyers for stocks on a basis that yields less than well-secured bonds, corporations are likely to continue to replace their bonds by stocks. Among new security issues during the last few months stocks have exceeded bonds, and the fashion of investing in possibility of future appreciation, instead of in safety and current income, has become so fully established that its reign does not yet seem seriously threatened.

But there is abundant historical evidence that fashions can change with great suddenness. Eventually the market for stocks will become saturated, because no one with cash will pay the price asked, and credit will not be obtainable except at the prohibitive rates which used to appear from time to time before the war. When that happens, the promise of the steadily increasing wealth of the world, upon which stocks are being purchased, will be ignored, and their prices will drop to whatever those who have cash are willing to pay for them.

It is altogether probable, as the buyers of stock assume, that the wealth of the world will be enormously increased within the next century. But it is also probable that this increase will be punctuated by reactions that will change sentiment and make people less eager to buy the equities that are represented by common stocks.

These changes in fashion are reflected in prices and even the most potentially profitable enterprises are not exempt. It is for this reason that buyers of stocks have traditionally demanded a larger yield than buyers of good bonds, whose income is as nearly certain as any income can be, and more than the experience of a year or two will be required to prove that this tradition ought now to be discarded.

The Reserve Banks have continued to subtract from the reserves, upon which credit expansion is based, by selling government securities and reducing their holdings of acceptances, but in the week ended last Wednesday rediscounts increased $37,000,000 and brokers' loans in New York jumped $140,000,000. A month has elapsed since the Reserve Board's warning was issued, and these loans are nearly as high as they ever were. And 12 per cent for call money on the Stock Exchange was cheerfully paid again.

That some of the more important banks of the country are co-operating with the authorities in an endeavor to keep money out of the stock market and in business can scarcely be doubted. But the foregoing shows how little success they are achieving, and in the long run it is doubtful whether any credit restriction that stops short of 25 to 50 per cent call money will directly check speculation. The true "Achilles' heel" of the stock market is in the effect of such money rates upon business, and, if building figures are as barometric as they have always been considered, the first sign that expansion has culminated is already at hand.

According to the F. W. Dodge Corporation the total of construction contracts awarded during February was 22 per cent less than for the same month last year. This sharp decline is the more impressive because it follows declines of 9 and 4 per cent in December and January, and because contemplated projects reported at the end of the month were 18 per cent less than a year ago.

A decline in building is important not only to the lumber, steel, cement and other materials industries, but to the makers of furnishings, equipment and machinery. That it has occurred despite record amounts of new capital raised during the last few months seems to indicate that much of that capital has gone not into fresh enterprise but, through investment trusts and other channels, into marking up the prices of enterprises already in operation. Credit expansion has outrun the expansion of industry and trade, and the propagandists of the "new era" may well reflect that such inflation has made several past eras appear "new" for a time though in retrospect they seem but part of the old cycle of expansion and contraction.

The steel, automobile and textile industries continue to operate at very high levels, in many cases at a record. The railroads are busy and reporting larger earnings than ever before. Distributive trade is large and the business turnover as a whole, with the exception of building and some of the second-rank industries, is probably the largest ever known. But in the circumstances it is not unreasonable to interpret the record activity as an approach to a peak, and that is the explanation many of the forecasters are now giving it.

In the general inertia of the markets some fear of the chilling hand of the Reserve authorities is present, and, while there can be little doubt that business during the next two or three months will make many records, the outlook for the second half-year suggests caution.

ALTHOUGH record-breaking sales were made in the machinery and machine-tool trade during the months of January and February, March prospects are not reported to be universally bright. For example, in Detroit, the unusually large sales made in the previous month have not as yet been carried into March. Business, however, is still above normal for this period and the small shops are buying equipment as well as the large one. In Buffalo, also, March is not expected to live up to the records of the two previous months since the leading purchasers there have already completed their buying.

IN CHICAGO, on the other hand, March sales are expected to exceed those of January and February by a good margin. In Milwaukee, there is no sign of a let-up in demand and record sales are expected this month. Nor has there been any noticeable let-up in demand in New England, and conditions in Cincinnati are reported as most satisfactory.

THE railroad situation shows signs of improvement: A leading concern in Philadelphia closed three large orders during the past week, one being the largest in some time. A large railroad shop is to be built in Milwaukee and much business is expected from this source. In Chicago, railroads will probably be the chief source of orders this month, since no action has as yet been taken on several large lists issued since the first of the year.

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The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

CHICAGO

If the business done in machine tools during the first week in March be taken as a criterion for the remainder of the month, the total will exceed those of both January and February by a good margin. That, at least, is the opinion expressed by some of the leading houses engaged in the machinery industry, and is based on the volume of inquiries and the number of actual sales booked.

No prominent producing or manufacturing interests can be credited with a major share of the present active demand generally reported. This comes from widely separated territories, and is diversified as to requirements. Railroads that have issued lists for shop equipment are considering bids and estimates, but little closing has thus far been reported. A Milwaukee tractor builder is in the market for a number of tools needed for an enlarged plant, and the information is to the effect that its complete list will be a substantial one.

Despite the fact that most machine tool plants are working overtime, deliveries still are far behind in most lines. This condition is expected to prevail for some months to come. Demand for used tools of standard make continues on a good level.

PHILADELPHIA

Two Eastern railroad companies and one Western carrier made some substantial purchases of machinery and machine tool equipment in the Philadelphia market during the last two weeks. The producer making the sales did not reveal the names of the roads nor the extent of the purchases, but one of the transaction was said to have been one of the largest the company has had from the carriers for some time. The same company reported substantial sales of industrial machinery.

Business generally was reported to be on a substantial basis during the last month. It is keeping abreast of what it was at this time in 1928, with inquiries of such a nature as to indicate there will be a continuance of the present briskness for some time.

Among the sales reported during the last two weeks were some horizontal and vertical drills, boring equipment and a number of planers. There were some orders from the automobile centers of Detroit, and some from one of the large aircraft manufacturers for shop equipment. The smaller machinery and machine tool dealers reported a falling off in business. Used machinery has not been in as great demand as it was some months ago.

DETROIT

The usually large number of sales in the machinery and machine tool market in the Detroit district that characterized February have not been carried into March, but the business has been at least above normal. Most of the dealers here predicted a larger business for March than for last month, but thus far this prophecy does not seem to have been borne out. Some large machines are being sold, mostly to two or three large automobile manufacturers. Small shops are still opening up and those already established are doing a very good business and are buying some equipment.

Inquiries are coming in fairly well, but none of them seem to indicate any unusually heavy demand. Several dealers have described their business as being normal and have expressed the belief that it will show signs of improvement when the weather opens up a little more and the sales of automobiles increase.

Among the outstanding producers are Chevrolet, Ford, Hudson and Graham-Paige, all of whom have made production records during the past two months. Business conditions in general are very good. Many car sales have been made for future delivery and the general atmosphere here is one of extreme optimism, some of it probably based on the inauguration of Mr. Hoover, who is expected to do much for the Middle West and the St. Lawrence district.

INDIANAPOLIS

Optimism seems to rule the machinery and machine tool market here. While the present demand is for single items for additions or replacements, the total sales volume is improving and from reports received from local tool manufacturers and sales representatives, there will be a good spring season. Already inquiries are being received for special construction machinery. In this field the machinery particularly adapted for road building seems to be the most wanted. The state's road building program this year will be large.

Another source of demand is opened from the many brick plants of the state. Several of them closed after the first of the year for the express purpose of making replacements and new installation. Some occasional sales are being made to the coal mines in the western part of the state.

More interest is being taken in equipment by garages now that spring is just around the corner. Grinding machines, small lathes and small drills are most in demand. Because of weather conditions, railroad buying has been cut to a minimum. It has been necessary for the roads to hold their rolling stock and motive power out of the shops as long as possible to move freight. With warmer weather, however, much of this equipment will be withdrawn for much needed repairs, and tool buying on the part of the roads should increase. Dealers in second-hand equipment report a fair demand.

BUFFALO

Machine tool dealers report that the first two months of the year were far beyond the same two months of a year ago in volume of business done. Some dealers report business 50 per cent more than that of two years ago for January and February, while one dealer says his volume this year is double that for the same period last year.

The buying has been largely diversified, but the big orders have been contributed by the aircraft industry, chiefly equipment for the new motor plant of the Curtiss Aeroplane & Motor Company, which, on completion, will probably be one of the finest and best-equipped plants of its kind in this country. However, the equipment buying for this plant is practically completed.

Some purchases of equipment, chiefly single machines for replacement of obsolete equipment or for special purposes, have been made by plants turning out parts for the motor car industry. While production is said to be stepped up considerably at the Pierce Arrow Motor Car Company plant, this company apparently is not in the market for new equipment. Railroads are not buying locally. There has been some improvement in the demand for contractors' equipment.

Although inquiries are still fairly active, leaders among the Buffalo dealers feel that there will be a slight falling off in demand for equipment during March. Many of the orders filled during the first two months of the year are the results of quotations made before the close of 1928.

NEW ENGLAND

No noticeable let-up in the machinery and machine tool market was noted here in the past week. Orders were again representative of a variety of purchasers and were well distributed. March, thus far, has shown no decline in orders placed, the textile and railroad industries of this section being the only latent buyers. Because of long deliveries quoted on high-production tools, buyers are inclined to be especially urgent in their demands, usually fruitlessly so. Many tool builders are still in a position to increase night operating schedules, which would materially brighten the delivery outlook, but the needed help is not available. At present there is a dearth of planer hands, grinders, lathe hands, milling machine operators and experienced toolmakers in the industrial centers of Rhode Island, Massachusetts and Connecticut.

Fall delivery is given on production machinery and the outlook is for even more extended deliveries. The reasons are obvious: Automotive production continues to climb, and aeronautical progress is measured by leaps and bounds. Added to this is the general spurt of the steel industry and the increased manufacture of new products in the electrical field, all of which tends to increase orders for machinery.

Industrial construction is at a high level, more so in fact than at any time in 1928. Fresh orders are seen from these sources. The Norton Co., Worcester, is to build a 4- and 5-story addition. Pawtucket, R. I., is to have a new manual training school involving an expenditure of $500,000, including equipment. A Stratford airplane builder with a new plant under construction, has already extended his plans to include another building with 35,000 sq.ft. of floor space to take care of added orders. The Aeronautical Chamber of Commerce of America has announced in its yearbook that Connecticut with New Jersey leads in the production of aircraft engines.

MILWAUKEE

Judging by the performance of the machine tool market during the first ten days of March, there has been no sign of a let-up in the demand for equipment, and it is freely predicted that another new record for monthly sales will be established. Order books of tool plants continue to be filled virtually to overflowing, it being found almost impossible to catch up with deliveries, with new business coming in at so high a rate as it has in recent months.

Using employment figures as a yardstick, Milwaukee industries are now operating at a peak for all time. Inasmuch as the largest group is the machinery industry, it denotes a remarkably strong position. The March report of employment shows 42,143 at work in the same shops that in February reported a combined pay-

roll of 40,707, and in January, 38,995, indicating a gain since Jan. 1 of 3,148 employes. Manufacturers of metal products, automobile engines, accessories, road and building construction machinery, tractors and farm machinery are straining every resource of production to meet the record-breaking demand for their products for immediate and future shipment, and the season of actual usage of most of these products is still from one to three months distant, depending upon the localities.

The Chicago, Milwaukee, St. Paul & Pacific Railway has decided to proceed with the construction of a new freight-car repair shop at West Milwaukee which will cost about $1,000,000 and require a large list of equipment now being compiled. The building will be 200x1,000 ft., and by doubling the present repair capacity, will make possible the handling of 24 cars daily. This project represents the largest prospective railroad purchase of equipment in Milwaukee for many years.

Tool builders report an excellent demand for export, adding to the difficulty of making prompt deliveries.

CINCINNATI

Machine tool manufacturers in the Cincinnati district report that in the past week business held up in a most satisfactory way. In a few instances the sales were slightly less than in the previous week, but in other instances there was a slight gain, and therefore, taking the trade as a whole, the market was sustained at its previous good level.

Selling agents report that the demand is increasing gradually in local and adjacent territory. The past week's sales, it is stated, were at a good level, showing some gain over the previous week.

An increased volume of sales in the week to concerns in the automotive industry and its allied trades is reported by several manufacturers, but, it is stated, the average purchase was not large. The backbone of the week's business, taking the industry as a whole, was the sale of single tools to general machinists. The buyers were well scattered over the country and their requirements were well diversified.

Manufacturers report that inquiries from all sections of the country flowed in freely during the week. The great majority of these were for single tools and replacements, but in an increased number of cases the requirements were two or more tools.

NEW YORK

Little change has taken place in the machine tool and machinery market in the metropolitan district. The same high activity that has been noted for the last two months is reported on all sides, and because an excellent volume of small, well diversified orders is being received, local dealers and factory representatives are very well satisfied with what they term a good, healthy condition. Most orders call for one or two machines, and one of the outstanding orders for the week was the sale of six machines to a concern in New Jersey. The largest single buyer at this time, however, is the General Electric Co., which continues to issue orders and inquiries almost daily. Among the equipment bought was a number of presses for use in the radio manufacturing department. Machinery is also being purchased for making talking movies and refrigerators.

Deliveries in some cases are being quoted for as far ahead as September, and on account of this condition in new machines dealers in used equipment are finding an active market. In fact the chief difficulty for this branch of the trade is to find the necessary equipment to turn over, and as a result there has been some bidding up on prices with a consequent increase in the turnover price.

Sales made by the Triplex Machine Tool Co. during the week included: One large "General" flexible press, one Ames bench miller, two Campbell nibblers, three sensitive drill presses, a gear milling machine, and a die milling machine.

Business Items

An addition to the plant of the former National Lamp Co. in Indianapolis, recently purchased by the P. R. Mallory Co., is to be constructed immediately. W. H. Knowles, vice-president of the company, is in Indianapolis to arrange removal of machinery from the East. The Mallory company will combine manufacturing divisions of Elkon, Inc., Weehawken, N. J., and the Knapp Electric Co., Port Chester, N. Y., in the Indianapolis plant. The addition to the present plant will house the company's metallurgical work. When in full operation the company expects to employ about 875 persons.

Purchase of an interest in the Stromberg Carbureter Co., a company holding nearly all of the capital stock of the Motor Devices Co., Chicago, has been made by men closely identified with the aviation industry. These are Richard F. White, chairman of the Wright Aeronautical Corporation; C. M. Keyes, head of the Curtiss Aeroplane & Motor Co.; and Vincent Bendix, president of the Bendix Corporation. William L. O'Neil, former vice-president of the Stromberg Co. was named president to succeed Charles W. Stiger, who retired. The annual report of 1928 showed a net profit for the year of $554,507.

Formation of the Simonds Worden White Co., Dayton, Ohio, from the A. A. Simonds Dayton Co., the Worden Tool Co., and R. J. Dowd Knife Works, was announced recently. Although under direct control of the one general board, the three subsidiaries will maintain separate business operations. It is understood that Harry Clifford Sergent, is Eastern district manager of the consolidated unit.

The Independent Pneumatic Tool Co., Aurora, Ill., manufacturer of electric and pneumatic drills and hammers, has announced plans for construction of a five-story addition, 185x122 ft., which will add 45,000 sq.ft. of factory space, at a cost of $160,000. The building will be completed by June 1, F. B. Hamerly, works' manager, announced. The company is going into a new field with high-frequency drills.

The only plant in the South manufacturing steel rolls, drums, and containers, and known as the Hotchfield Steel Co., will begin operations about May 1, according to Wallace Hotchfield, president. The company has leased a plant in Birmingham, adjoining the Birmingham Galvanizing Co. Fred Clifford and B. H. Hotchfield will serve as vice-presidents of the new concern.

The General Super-Diesel Motors Corporation has been chartered under the laws of Delaware with a capitalization of 250,000 common shares of $10 par value each to manufacture a "super-Diesel" engine designed for use in railroad locomotives, auto trucks, passenger buses, and stationary power plants and marine vessels.

The Columbia Metal Products Co. of Chicago, a $500,000 corporation, will move to La Porte, Ind., in a short time and be in production by May 1, according to an announcement by officials of the La Porte Chamber of Commerce. The factory will employ 150 men at first. The company has leased the factory formerly operated by the Great Western Manufacturing Co. as a bicycle plant.

Robbins & Myers, Inc., successors to the Robbins & Myers Co., of Springfield, Ohio, manufacturers of electric motors, generators and fans, have established a district sales branch in Atlanta to handle the company's trade in the group of southeastern states. A warehouse will also be opened in Atlanta. Carl V. Malone has been named manager of the branch.

The organization of Continental-Diamond Fibre Co. to acquire the Continental Fiber Co., of Delaware, established in 1906, and the Diamond State Fiber Co., of Bridgeport, Pa., established in 1891, is being arranged by Hayden, Stone & Co. The products of the companies are complementary rather than competitive.

The Aeroil Burner Co., Inc., Park Ave. at 113th Street, West New York, N. J., has announced that for the convenience of customers in the Middle Western territory, it will maintain a stock of Aeroil Heaters and parts at its new branch office, 176 North Wacker Drive, Chicago.

The Wesling Brothers Foundry Co., Cincinnati, Ohio, has purchased the American Foundry and Machine Co., Hamilton, Ohio, and with this announcement, A. G. Wesling stated that the Cincinnati plant will be disposed of and the company will make its future home at Hamilton.

The Porter-Cable Machine Co., Syracuse, N. Y., has appointed Manning, Maxwell & Moore, 27 N. Jefferson St., Chicago, as exclusive representatives on Porter-Cable production lathes in parts of Illinois, Iowa and Indiana.

The Kelsey-Hayes Wheel Co., Detroit, acquired control of the Wire Wheel Corporation of America, Buffalo, and it is expected the transfer will result in some large scale economies and an increased production.

The Grand Rapids (Mich.) Metalcraft Corporation expects to open a branch factory in Detroit for the manufacture of the "Kelch" ventilating heater.

The Shaw-Walker Co., Muskegon, Mich., is building a five-story addition to its plant. The new building will be used for the production of a new type of steel desk.

The Monroe (Mich.) Auto Equipment Co. is building an addition to its plant for the manufacture of hydraulic shock absorbers.

The United Engineering & Foundry Co. has moved its foundry department from the Frank Kneeland Works, Pittsburgh, to Youngstown, Ohio.

Personals

D. F. JONES is now manager of the New York district office of Cutler-Hammer, Inc., manufacturer of electric motor controls and allied apparatus. Mr. Jones was formerly manager of the Pittsburgh office of the company. He succeeds C. W. Yerger, who leaves the company to accept a position with the Hanson-Van Winkle-Munning Co., Matawan, N. J. T. S. TOWLE, formerly sales engineer of the Pittsburgh office, becomes manager at Pittsburgh.

D. P. CAREY, master mechanic of the Midland Division of the New York, New Haven & Hartford R.R. has been appointed superintendent of shops with headquarters at Readville, Mass. W. R. SEDERQUEST has been appointed master mechanic of the Midland division with headquarters at Boston, succeeding Mr. Carey, and J. B. PORTER has been appointed master mechanic of the Old Colony Division with headquarters at Taunton, Mass., succeeding Mr. Sederquest.

W. FRANK ROBERTS has been elected chairman of the Berliner-Joyce Aircraft Corporation of Baltimore, Md. Mr. Roberts was formerly general manager of the Sparrows Point Division of the Bethlehem Steel Co. He is now president and chairman of the Standard Gas Equipment Co. of Baltimore. Officers of the Berliner-Joyce Aircraft Corporation are: W. W. Moss, president; Henry A. Berliner, vice-president in charge of production, and Temple N. Joyce, vice-president in charge of sales.

EDWIN P. ROOT, president of the New Haven Clock Co., New Haven, Conn., has resigned after 54 years in the service of the company and has become chairman of the board. Mr. Root is succeeded as president by R. H. Whitehead, formerly vice-president of the company.

MAXWELL A. COE, formerly superintendent of the Stanley Rule & Level Division of the Stanley Works at New Britain, Conn., has been made manager. In his new position Mr. Coe will assume some of the duties of Philip B. Stanley, who resigned recently from the vice-presidency.

GEORGE E. SCOTT was elected president of the American Steel Foundries, succeeding Robert P. Lamont, Secretary of Commerce in President Hoover's Cabinet, who resigned. R. H. RIPLEY, former second vice-president, was made senior vice-president and THOMAS DREVER, secretary and treasurer.

K. G. BAKER, formerly connected with the Century Electric Co. and the Fulton Iron Works, both of St. Louis, has joined the Cincinnati sales force of the Wagner Electric Corporation, also of St. Louis.

LEONARD S. HORNER, president, Niles-Bement-Pond Co., New York, and CARL A. JOHNSON, president Gisholt Machine Co., Madison, Wis., have both been nominated as candidates to the board of directors of the United States Chamber of Commerce.

WALTER E. SJODEN has been appointed manager of the Birmingham plant of the American Radiator Co., succeeding A. D. Nichols, deceased. He has been superintendent of the plant for the past two years.

ROBERT P. LAMONT has resigned as president of the American Steel Foundries and of the General Steel Casting Corporation, in order to become Secretary of Commerce in President Hoover's Cabinet.

L. DALE HAGENBOOK, plant engineer for the Ross Gear and Tool Co. of Lafayette, Ind., has resigned to take a position as assistant chief engineer with the Northwest Engineering Co. at Green Bay, Wis.

WALTER J. MILLER, former president of the Northwestern Steel & Iron Works, has been elected a director and vice-president of Foote Bros. Gear & Machine Co., Chicago.

JAMES S. WATSON has been elected a vice-president of the Link-Belt Co., Indianapolis. He has been with the company for 37 years.

J. C. HUSSEY, formerly advertising manager, has been made general sales manager of the American Tool Works Co., Cincinnati, Ohio.

CARL S. NEUMANN, was elected president of the Union Manufacturing Co., New Britain, Conn., to succeed Albert F. Corin, resigned.

CLARK S. JUDD has been elected vice-president of the American Brass Co., Waterbury, Conn.

Obituaries

DAVID D. BUICK, who developed the automobile bearing his name, died of cancer March 6 in Detroit. He was 74 years old. Throughout his life the fortune he seemed to deserve was just beyond his reach, and, while the fruits of his genius and labor brought wealth to many others, Mr. Buick's last illness found him an information clerk in the reception room of a trade school. After selling his interest in the General Motors Co., in 1919, Mr. Buick invested in oil in California where he lost all his wealth.

T. F. MERSELES, president of the Johns-Manville Corporation, died March 7 at Del Monte, Calif., from heart disease. He was 65 years old. In 1893 he organized the Western Wheel Works which was merged with the Pope and A. G. Spalding bicycle companies, Mr. Merseles remaining as vice-president of the consolidation until 1903, after which he transferred his activities to the mail order business and finally joined the Johns-Manville organization.

EDWARD P. FREDERICK, general superintendent of the Broderick & Bascom Rope Co., St. Louis, Mo., and connected with that firm for 52 years, died in St. Louis on Feb. 26. He was 74 years old. Mr. Frederick installed the first power machinery for rope making west of the Alleghenies in St. Louis in 1878 and later invented improved machinery now in use in the St. Louis and Seattle plants of the company.

CHARLES W. BINGHAM, son of the founder of the William Bingham Co., Cleveland, Ohio, wholesale hardware, machinery and tool dealer, died March 1 at Cleveland. He retired 15 years ago, although retaining directorships in various companies. He was formerly president of the Standard Tool Co., Cleveland, and a director of the Cleveland Cliffs Iron Co., the Bourne-Fuller Co., and the Union Trust Company.

ALBERT W. ATKINSON, former assistant treasurer and member of the board of the Victor Talking Machine Co., died March 6 at the age of 68. He started to work in the Risdon foundry and later became an apprentice at the H. B. Smith Machine Co. in Smithville. He was one of the group forming the Victor company in 1901, and started as a foreman in the machine shop.

WALTER C. ARTHURS, president and director, Mount Vernon Car Manufacturing Co., Mount Vernon, Ill., died recently. He was a director of the Illinois Manufacturers' Association, Chicago, and also of the Association of Manufacturers of Chilled Car Wheels.

Forthcoming Meetings

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Regional meeting in Knoxville, Tenn., March 21-22. Eastern spring meeting in Rochester, N. Y., week of May 13. Third national meeting of the aeronautic division, St. Louis, Mo., May 27-30. Semi-annual meeting, Salt Lake City, Utah, July 1-4. Calvin W. Rice, secretary, 29 West 39th St., New York City.

NATIONAL METAL TRADES ASSOCIATION. Convention, Hotel Drake, Chicago, April 24-25. J. E. Nyhan, national secretary, Peoples Gas Building, Chicago, Ill.

AMERICAN WELDING SOCIETY. Annual meeting, April 24-26, at the Engineering Societies Bldg., New York. M. M. Kelly, secretary, 29 West 39th St., New York.

AMERICAN MANAGEMENT ASSOCIATION. Annual meeting, Hotel Pennsylvania, New York, May 7. W. J. Donald, managing director, 20 Vesey St., New York.

AMERICAN GEAR MANUFACTURERS' ASSOCIATION. Thirteenth annual meeting to be held in the Hotel Statler, Cleveland, Ohio, May 16-18. T. W. Owen, secretary, 3608 Euclid Ave., Cleveland.

AMERICAN SOCIETY FOR TESTING MATERIALS. Annual meeting, June 24-28, at the Chalfonte-Haddon Hall, Atlantic City, N. J. C. L. Warwick, secretary, 1315 Spruce St., Philadelphia, Pa.

SOCIETY OF AUTOMOTIVE ENGINEERS. Summer meeting, Saranac Inn, Upper Saranac Lake, N. Y., June 25-28. Coker F. Clarkson, manager, 29 E. 39th St., New York.

The Weekly Price Guide

Rise and Fall of the Market

BUYING of steel bars, sheets and strips is passing from a hand-to-mouth basis to one in which future requirements are considered. Most of the other items listed are still being purchased to fill immediate needs only. Fabricated steel structurals, pipe and plates are moving in large volume with no changes in price. Copper, lead, fabricated brass and copper, zinc sheets, scrap copper, brass and lead, are higher in price than a week ago in the principal markets. Tin continues weak.

(All prices as of Mar. 8, 1929)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b:

CINCINNATI	
No. 2 Southern (silicon 1.75@2.25)	$19.94
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 1.75@2.25)	25.50
BIRMINGHAM	
No. 2 Foundry (silicon 1.75@2.25)	16.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	21.76
Virginia No. 2	27.17
Basic	20.76
CHICAGO	
No. 2 Foundry local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 1.75@2.25)	22.26
PITTSBURGH, including freight charge ($1.75) from Valley:	
No. 2 Foundry	19.26
Basic	19.26
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb:

Detroit	4.50
Cleveland	5.00
Cincinnati	4.50
New York	5.25
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots:

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.10@2.20	3.35	3.25	3.90*
No. 12	2.15@2.25	3.40	3.30	3.95*
No. 14	2.25@2.35	3.45	3.35	4.00*
No. 16	2.35@2.45	3.55	3.45	4.10*
Black				
Nos. 18 to 20	2.65@2.75	3.60	3.40	3.80
No. 22	2.80@2.90	3.75	3.55	3.95
No. 24	2.85@2.95	3.80	3.60	4.00
No. 26	2.95@3.05	3.90	3.70	4.10
No. 28	3.10@3.20	4.50	3.85	4.25
Galvanized				
No. 10	2.80@2.90	3.95	3.75	4.05
Nos. 12 to 14	2.90@3.00	4.05	3.85	4.15
No. 16	3.00@3.10	4.15	3.95	4.25
No. 18	3.15@3.25	4.30	4.10	4.40
No. 20	3.30@3.40	4.45	4.30	4.55
No. 22	3.35@3.45	4.50	4.35	4.60
No. 24	3.60@3.70	4.65	4.45	4.75
No. 16	3.75@3.85	4.90	4.70	5.00
No. 28	4.00@4.10	5.15	4.95	5.25

*Up to 3,999 lb.

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in., butt welded	50%	36%	55½%	43½%	54%	41%
2½ to 6 in., lap welded	45%	32%	53½%	40½%	51%	38%

WROUGHT-STEEL PIPE LIST

Size, Inches	List Price per Foot	Diameter in Inches—External	Diameter in Inches—Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb:

— Thickness — B.w.g. and Decimal Fractions		Outside Diameter in Inches ½	⅝	¾	⅞	1	1⅛	1¼
		Price per Foot						
.035″	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049″	18	.17	.18	.19	.20	.21	.23	.25
.065″	16	.19	.20	.21	.22	.23	.25	.27
.083″	14	.20	.22	.23	.24	.25	.27	.29
.095″	13	.21	.23	.25	.26	.27	.29	.31
.109″	12	.22	.24	.26	.27	.28	.30	.32
.120″ or .125″	11	.23	.25	.27	.28	.29	.31	.33
.134″	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.25†	4.00	4.15
Cold rolled strip steel	6.25	6.00	6.10
Floor plates	5.10†	5.30	5.00
Cold drawn, round or hexagon‡	3.50	3.65	3.60
Cold drawn, flat or square‡	4.00	4.15	4.10
Structural shapes	3.30†	3.00	3.10
Soft steel bars	3.25†	3.00	3.00
Soft steel bar shapes	3.25†	3.00	3.00
Soft steel bands	3.75†	3.65	3.65
Tank plates	3.30†	3.00	3.10
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

*Flat, $\frac{3}{16}$-in. thick. †Up to 3,999 lb., ordered and released for shipment at one time. ‡Cold finished steel, shafting and screw stock.

Electric welding wire, New York, $\frac{3}{32}$, 8.35c.; $\frac{1}{4}$, 7.85c.; $\frac{5}{32}$ to $\frac{1}{2}$, 7.35c. per lb.

METALS

Warehouse Prices in Cents Per Pound for Small Lots:			
Copper, electrolytic, New York			19.25
Tin, Straits, pigs, New York			52.00
Lead, pigs, E. St. Louis	7.20	New York	8.25
Zinc, slabs, E. St. Louis	6.35	New York	8.00

	New York	Cleveland	Chicago
Antimony, slabs	12.75	12.50@13.50	14.25
Copper sheets, base	27.75	29.12½	28.62½
Copper wire, base	23.62½	21.00	22.87½*
Copper bars, base	26.25	27.62½	27.12½
Copper tubing, base	28.87½	30.12½	29.75
Brass sheets, high, base	22.75	23.75	23.37½
Brass tubing, high, base	27.62½	28.62½	28.25
Brass rods, high, base	20.50	21.50	21.12½
Brass wire, high, base	23.25	24.50	23.87½

*At mill.

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%.....	25.00*	24.30	24.30
Zinc sheets (casks).....	11.00@11.50	11.70	10.11
Solder (½ and ½).....	34.75	34.00	31@34
Babbitt metal, delivered in case lots, New York, cents per lb:			
Genuine, highest grade.....			69.00
Commercial genuine, intermediate grade.....			53.00
Anti-friction metal, general service.....			31.50
No. 4 babbitt (f.o.b.).....			12.25

*Delivered.

NICKEL AND MONEL METAL—Price in cents per lb., base, f.o.b. Huntington, W. Va:

	Nickel	Monel Metal
Sheets, full finished.....	52.00	42.00
Sheets, cold rolled.....	60.00	50.00
Strip, cold rolled.....	55.00	45.00
Rods, hot rolled.....	45.00	35.00
Rods, cold rolled.....	53.00	40.00†
Tubing.....	75.00*	90.00
Angles, hot rolled.....	50.00	40.00
Plates.....	52.00	42.00

*Seamless. †Cold drawn.

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars, depending on quantity offered for sale:

	New York	Cleveland	Chicago
Crucible copper.....	17.00 @17.25	15.25	15.75 @16.25
Copper, heavy, and wire..	16.00 @17.00	14.75	15.12½@15.50
Copper, light, and bottoms	14.25 @14.75	12.50	13.75 @14.25
Heavy lead.....	6.00 @ 6.25	6.25	5.25 @ 5.75
Tea lead.....	4.50 @ 5.00	4.25	4.25 @ 4.75
Brass, heavy, yellow.....	10.00 @10.50	10.00	9.75 @10.25
Brass, heavy, red.....		12.75	13.00 @13.50
Brass, light.....	8.25 @ 8.75	8.25	8.75 @ 9.25
No. 1 yellow rod turnings.	10.00 @10.50	10.50	10.75 @11.25
Zinc.....	3.25 @ 3.75	3.25	3.00 @ 3.50

TIN PLATES—Charcoal—Bright—Per box:

	New York	Cleveland	Chicago
"AAA" Grade:			
IC, 14x20.....	$12.10	$11.95	$11.50
"A" Grade:			
IC, 14x20.....	9.70	9.90	9.50
Coke Plates—Primes—Per box:			
100-lb., 14x20.....	6.45	6.10	7.00
Terne Plates—8-lb. Coating—Small lots—Per box:			
IC, 14x20.....	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.*	$0.10@0.13½	$0.16	$0.15
Cotton waste, colored, per lb.*	.09@ .13	.12	.12
Wiping cloths, washed white, per lb.†.....	.16	38.00 per M	.16
Sal soda, per lb.....	.02	.02	.02
Roll sulphur, per lb.....	.027	.03½	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb.....	.11	.11	.114
Cutting oil, about 25% lard, in 5 gal. cans, per gal.....	.55	.60	.65
Machine oil, medium-bodied (55 gal. steel bbl.) per gal..	.33	.36	.35
Belting — Present discounts from list in fair quantities (½ doz. rolls) for leather or rubber:			
Leather—List price, 24c. per lin. ft., per inch of width, for single ply:			
Medium grade.....	30–10%	30–10%	35%
Med. grade, heavy wgt...	30– 5%	30– 5%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft:			
First grade.....	50%	50–10%	50%
Second grade.....	60%	60– 5%	50–10%

*All waste in bale lots. †100-lb. bales.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars.....	per lb..	$0.0325	$0.0325	$0.0324
Cold drawn shafting...	per lb..	.035	.035	.034
Brass rods.....	per lb..	.205	.1925	.165
Solder (½ and ½).....	per lb..	.3475	.345	.3325
Cotton waste, white...	per lb..	.10@.13½	.10@.13½	.10@.13½
Disks, aluminum oxide mineral, cloth, No. 1, 6-in. dia.....	per 100.	3.59	3.59	3.10
Lard cutting oil.....	per gal.	.55	.65	.65
Machine oil.....	per gal.	.33	.30	.27
Belting, leather, medium.....	off list.	30–10%	30–10%	35%
Machine bolts, up to 1x30 in., full kegs...	off list..	50-10%*	50–10%*	50%*

*List prices as of April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials — Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
Flint paper.....	$4.05	$4.29	$4.2
Emery cloth.....	20.22	20.97	20.9
Disks, aluminum oxide mineral, 6 in. dia., No. 1, per 100:			
Paper	2.04	2.04	2.04
Cloth.....	3.59	3.59	3.59
Fire clay, per 100 lb. bag.....	1.00	.75	.75
Coke, prompt furnace, per net ton...	Connellsville,		2.75@2.8
Coke, prompt foundry, per net ton...	Connellsville,		3.75@4.50
White lead, dry or in oil...	100 lb. kegs....	New York,	13.50
Red lead, dry.....	100 lb. kegs....	New York,	13.5
Red lead, in oil.....	100 lb. kegs....	New York,	15.0

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

Machine bolts	
Up to ¾-in. x 6-in., full kegs, list less.....	60%
Larger, up to 1 x 30-in., full kegs, list less.....	50–10%
Less than full kegs or case lots, add to list.....	10%
Fitting-up bolts: list less.....	45%
Lag screws:	
Up to ½-in. x 6-in., list less.....	60%
Larger, list less.....	50–10%
Less than full keg or case lots, add to list.....	10%
Rivets:	
Structural, round head, full kegs, net.....	$4.50
Structural, round head, broken kegs, net.....	6.00
Tank, 7–16-in. dia. and smaller, list less.....	60%
Nuts:	
Hot pressed, square or hexagonal, blank or tapped:	
Full kegs up to 1-in., incl., list less.....	60%
Larger, up to 3-in., list less.....	40–10%
Less than keg or case lots, add to list.....	10%
Washers:	
Wrought, full kegs, per 100 lb., list less.....	$4.00
Wrought, broken kegs, per 100 lb., list less.....	2.00
Turnbuckles:	
With stub ends, list less.....	20%
Without stub ends, list less.....	50%
Chain:	
Proof coil, base, per 100 lb., net.....	$7.10
Cast iron welding flux, per lb., net.....	.40
Brazing flux, per lb., net.....	.80

Machine Requirements and Industrial Construction

Equipment Wanted

Mass., Boston—National Mill Supply Co., 184 Summer St.—self-contained jig saw.

Mass., Fall River — F. A. Pigeon, 16 River St.—jack hammer drill, steam driven.

Mass., Holbrook — P. H. Lother, 284 North Franklin St.—blacksmith forge, tools and anvil.

Mich., Detroit — Bower Roller Bearing Co., 3040 Hart Ave.—grinders.

Mich., Detroit — City Pattern Works, Rivard St. and Harper Ave.—machinery and equipment for proposed 1 and 2 story pattern shop. Estimated cost $50,000.

Mich., Detroit — Detroit Sheet Metal Works, 1340 East Milwaukee Ave.—sheet metal working equipment for proposed 1 story, 90 x 160 ft. plant. Estimated cost $45,000.

Mich., Detroit—National Machine Products Co., 4850 Bellevue Ave.—heat treating equipment for 1 story, 35 x 70 and 2 story, 50 x 162 ft. factory.

Mich., Ecorse—Great Lakes Steel Corp., c/o G. R. Fink, Michigan Steel Corp., 121 Book Bldg.—machinery and equipment for the manufacture of open hearth steel ingots, hot and cold rolled steel, light plates and forging billets, etc., for proposed steel plant. Estimated total cost $20,000,000.

Mich., Jackson—Sparks-Withington Co., North St. and M. C. R.R.—miscellaneous equipment for the manufacture of automobile horns and radiator fans for proposed 3 story, 60 x 250 ft. accessory factory on North St. Estimated cost $150,000.

Mich., Monroe—Newton Steel Co., First National Bank Bldg.—Youngstown, O.—machinery and equipment for the manufacture of steel sheets for proposed mill. Estimated cost $1,000,000.

Mich., Pontiac—Oakland Motor Car Co.—machinery and equipment for proposed 1 story automobile assembly plant. Estimated cost $100,000.

N. Y., Buffalo—Bd. of Education, 900 Genesee Bldg.—will receive bids until Mar. 21 for manual training shop equipment for schools 23, 47 and 53.

O., Euclid (Cleveland P. O.) — Euclid Crane & Hoist Co., Chardon Rd.—three spindle, 3 in. capacity (Foote-Burt) rail drill.

O., Portsmouth—Mayo Equipment Co., J. C. C. Mayo, Pres. (automobile equipment)—several lathes, 24 in., two drill presses, automatic machine and large grinder for recently acquired plant.

Opportunities for Future Business

Calif., San Francisco—Laher Spring Co., 167 Hayes St., manufacturers of automobile springs, awarded contract for a 1 story, factory at 11th St. and Burnes Pl. Estimated cost $40,000.

Calif., Whittier — Pacific Gas Radiator Co., 7541 Roseberry St., Los Angeles, is having preliminary plans prepared for the construction of a factory at Workman Mill Rd.

Conn., Bridgeport—Bridgeport Brass Co., R. Day, Gen. Mgr., is having plans prepared for a 1 story, 75 x 200 ft. brass rolling mill on Housatonic Ave. Estimated cost $40,000. Fletcher-Thompson, Inc., 542 Fairfield Ave., Archt. Noted Dec. 13.

Conn., Hartford—Hartford Electric Light Co., S. Ferguson, Pres., Pearl St., will receive bids about Mar. 15, for a 4 story, 160 x 180 ft. service building on Sheldon St. Estimated cost $400,000. Smith and Bassette, 36 Pearl St., Archt. E. W. Wiggin, 113 Church St., New Haven, Engr.

Conn., Hartford — Ideal Auto Body Works, 1702 Main St., is receiving bids for a 2 story, 38 x 90 ft. plant on Main St. Estimated cost $40,000. A. Feinberg, 1127 Main St., Archt.

Conn., Meriden—New Departure Mfg. Co., Pratt St., awarded contract for the design and construction of a 4 story, 106 x 220 ft. addition to plant.

Conn., Milford—Wright & Corson Co., 71 Charlotte St., Bridgeport, manufacturers of rivets, awarded contract for a 1 story, 25 x 112 and 155 x 250 ft. factory at Milford turnpike. Estimated cost $300,000. Fletcher-Thompson, Inc., 542 Fairfield Ave., Bridgeport, Archts. Noted Feb. 21.

Conn., Waterbury — Geghan & Allerton Inc., 379 West Main St., plans the construction of a garage and repair shop on Meadow St. Estimated cost to exceed $40,000.

Ill., Bloomington—Williams Oil-O-Matie Heating Corp. awarded contract for 127 x 300 and 100 x 200 ft. additions to factory. Estimated cost $57,000.

Ill., Chicago—Jensen Radio Mfg. Co., 338 North Kedzie Ave., plans the construction of a plant at 6601 South Lorel Ave.

Ill., Chicago — Runzel Lentz Electric Mfg. Co., 1751 North Western Ave., awarded contract for a 105 x 108 ft. addition to factory for the manufacture of electrical supplies. Estimated cost $35,000.

Ill., Forest Park — Edward Roos Co., 7329 Harrison St., manufacturers of cedar chests, plans a 3 story addition to factory. Estimated cost $25,000.

Ill., Monticello—Tylac Co. Inc., recently organized, plans the construction of a plant for the manufacture of a lacquered wood fiber tile for interior building use. Estimated cost $40,000.

Ill., Rockford—Rockford Gas & Electric Service, had plans prepared for a 1 story, 100 x 200 ft. garage at South 4th St. and First Ave. Estimated cost $75,000. Private plans.

Ind., Fort Wayne — International Harvester Co., 606 South Michigan Blvd., Chicago, Ill., awarded contract for a 2 story factory on Bueter Rd. Estimated cost $100,000.

Mass., Cambridge (Boston P O.)—Cambridge Salvage & Supply Co., 91 Broadway, awarded contract for a 2 story, 70 x 90 and 85 x 85 ft. plant. Estimated cost $40,000.

Mass., Greenfield—J. F. King, King's Hotel, plans the construction of a 1 story repair and service garage at Bank Row. Estimated cost $40,000. Architect not selected.

Mich., Dearborn — Ford Motor Co., is having plans prepared for the construction of an open hearth steel mill on Coolidge Highway. Estimated cost $75,000. Giffels & Vallet, Marquette Bldg., Detroit, Engrs.

Missouri—Kansas-Missouri Pacific R.R., Missouri Pacific Bldg., St. Louis, awarded contract for the construction of a 120 x 300 ft. roundhouse at Osawatomia, Kan., also addition to round house and machine shop at Poplar Bluff, Mo., and 60 x 90 ft. garage at Poplar Bluff, Mo., to be used by Missouri Transportation Co., a subsidiary.

Mo., Marshall — Nicholas-Beazley Airplane Co., Inc., R. Nicholas, Pres., English and North Sts., will soon receive bids for a 1 story, 50 x 155 ft. addition to airplane factory. Estimated cost $40,000. Private plans.

Nev., Reno — Nevada State Highway Dept., Heroes Memorial Bldg., Carson City, awarded contract for the construction of machine shops, etc., here.

N. J., Clifton—Owner, c/o F. Pirrone, 104 Midland Ave., Garfield, Archt., is having preliminary plans prepared for a 2 story, 100 x 200 ft. garage here. Estimated cost $150,000.

N. Y., Astoria—S. Norman, 1064 East 7th St., Brooklyn, will build a garage at 15th and Astoria Aves. Estimated cost $40,000. Farber & Kalkin, Archts.

N. Y., Brooklyn—Franklin Kent Corp., R. V. Rau, Pres., plans the construction of a 2 story machine shop, etc., at Kent and Park Aves. Estimated cost $40,000. Koch & Wagner, 32 Court St., Archts.

N. Y., Brooklyn—Metal Hose & Tubing Co., J. M. Oden, Pres., 253 Tillary St., plans addition to factory at Tillary and Navy Sts. Estimated cost $70,000. A. Ulbrich, 371 Fulton St., Archt.

N. Y., Brooklyn—United Metal Box Co., S. Klein, Pres., President and Nevins Sts., plans addition to plant. Estimated cost $40,000. M. J. Harrison, World Bldg., New York, Archt.

N. Y., Elmhurst—M. Pomerantz, Middle Valley, will build a garage at 79th St. and 46th Ave. Estimated cost $60,000. M. Perlstein, Middle Valley, Archt.

N. Y., Flushing — W. A. Walsh & Co. plans the construction of a garage, etc., at Dalia Ave. and Jaggar St. Estimated cost $70,000. A. H. Eccles, 76 Hoyt Ave., Astoria, Archt.

N. Y., New York—H. L. Boome, Inc., W. C. Jackson, Pres., 54 East 56th St., will build a 6 story, 100 x 154 ft. garage at 152 East 87th St. M. J. Ort, 424 East 149th St., Archt. Noted Feb. 14.

N. Y., New York — Second Ave. and Ninety First Realty Corp., I. Ehrman, Pres., 41 Park Row, plans a 4 story, 75 x 102 ft. garage at 431 East 71st St. Estimated cost $60,000. W. Shary, 41 Union Sq., Archt.

O., Alliance — A. M. Byers Co., Clark Bldg., Pittsburgh, Pa., awarded contract for the construction of a plate mill here. Estimated cost including equipment $80,000.

O., Cleveland — Cleveland Heater Co., 1900 West 112th St., is receiving bids for a 1 story, 72 x 100 ft. addition to factory. Estimated cost $40,000. G. S. Rider Co., Century Bldg., Archt.

O., Cleveland—Wheel Lock-Lovejoy Co., 1802 Columbus Rd., awarded contract for a 1 story, 48 x 52 ft. addition to factory at East 53rd St. and Hamilton Ave. Estimated cost $40,000.

O., Dayton—National Cash Register Co., Main and K St., is receiving bids for a 6 story, 80 x 480 ft. factory on K St. Estimated cost $700,000. Private plans. Noted Feb. 7.

Pa., Pittsburgh — Kerotest Mfg. Co., Liberty Ave., awarded contract for a 3 story, 50 x 100 ft. addition to plant. Estimated cost $100,000. Noted Feb. 21.

Pa., Pittsburgh — Pittsburgh Piping & Equipment Co., 43rd St., awarded contract for a 2 story, 40 x 100 ft. addition to plant on 41st St. Estimated cost $40,000.

R. I., Providence—Patton-MacGuyer Co., Baker St., manufacturers of brass goods, awarded contract for a 1 story, 80 x 160 ft. factory.

S. C., Spartanburg—Draper Corp., manufacturers of looms and textile machinery and parts, awarded contract for a 2 story, 104 x 264 ft. factory.

Wis., Milwaukee — Industrial Controller Co., 306 Hanover St., awarded contract for a 3 story, 50 x 140 ft. addition to factory, for the manufacture of electrical and mechanical controlling devices. Noted Feb. 7.

Ont., Peterborough—Western Clock Co., Hunter St. N., plans the construction of a 4 story, 80 x 200 ft. addition to factory. Estimated cost $100,000. Noted Jan. 24.

Ont., Port Colbourne — International Nickel Co. awarded contract for the construction of three electrolytic refining units. Estimated cost $1,500,000. Private plans.

Ont., Windsor—Canadian Pacific Ry. Co., Montreal, Que., plans addition to round house and shops here. Estimated cost $250,000. J. M. R. Fairbairn, Ch. Engr.